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SPECIAL NOTICE

The Introduction to this issue of *Scientific and Technical Aerospace Reports (STAR)* has been extensively revised. It is intended to provide a comprehensive and structured explanation of the journal contents and the various availabilities of announced documents. The introduction should be carefully read by all users of *STAR*.

A new symbol has been added to certain citations in *STAR* to identify those documents that may present unusual problems of reproducibility. Documents that can not be microfiched, but for which a one-to-one facsimile hard copy can be provided, are indicated by a plus (+) sign following the accession number in place of the microfiche (#) symbol. The Introduction provides further information concerning the availability of such documents, including those for which neither + nor # symbols appear in the citation.

Scientific and Technical Aerospace Reports

Abstracts

INTRODUCTION

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The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA Thesaurus* should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the Clearinghouse for Federal Scientific and Technical Information or the U.S. Government Printing Office at $8.50 for the three-volume set.

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02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **5**

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Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **7**

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Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **9**

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Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. **30**

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Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **52**

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Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics. **58**

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Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. **64**

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Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories. **70**

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Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics. **182**

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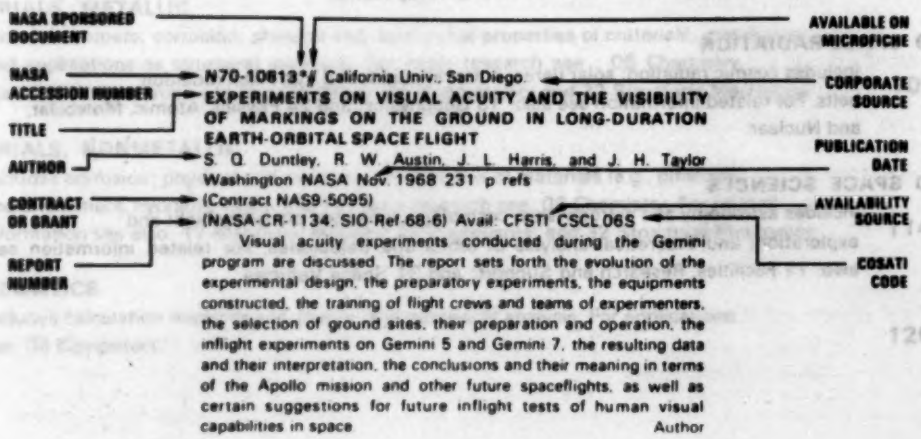
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N70-10813*# California Univ., San Diego.
CORPORATE SOURCE
TITLE
EXPERIMENTS ON VISUAL ACUITY AND THE VISIBILITY OF MARKINGS ON THE GROUND IN LONG-DURATION EARTH-ORBITAL SPACE FLIGHT
AUTHOR
S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
PUBLICATION DATE
Washington NASA Nov. 1968 231 p refs
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(Contract NAS9-5095)
AVAILABILITY SOURCE
(NASA-CR-1134, SIO-Ref-68-6) Avail: CFSTI CSCL 06S
REPORT NUMBER
COSATI CODE
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space
Author

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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N70-10116# Aeronautical Research Labs., Melbourne (Australia).
PERFORMANCE OF AN ATTITUDE SENSING HEAD WITH FLUSH PRESSURE HOLES. TRANSONIC WIND TUNNEL MEASUREMENTS AND CROSS FLOW THEORY CORRELATION
D. A. Secomb Feb. 1969 39 p refs
(ARL/A-310) Avail: CFSTI

The sensitivity of an attitude sensing head having four flush pressure holes in a spherical nose tangent to a 2.9 calibre ogive has been determined, using a quarter scale model. For angles of attack (alpha) up to 20 deg, the differential pressure (delta Cp) variation may be represented as delta Cp = −K sin 2 alpha, where the value of K varies from about 0.04 to 0.03 per deg, over the test Mach number range of 0.5 to 1.3. The results were found to correlate well on the basis of Lotz's cross flow theory provided the compressible form of the relation between speed and pressure was used. Using the correlation a theoretical examination was made of the procedure for determining roll orientation from the ratio of the differential pressures measured in two perpendicular planes, and the angle of attack from their root mean square value. The examination showed that the errors arising from this procedure should not exceed 0.3 deg, for angles of attack up to 20 deg. Author

N70-10198# New York Univ., N.Y. School of Engineering and Science.
LIFT IN LARGE ORDER UNSTEADY OSCILLATING TWO DIMENSIONAL FLOW
Walter Lorell and Leon Bennett Mar. 1969 24 p refs
(Contract NSF GK-1673)
(PB-183990; TR-1426.02) Avail: CFSTI CSCL 01A

The classic treatment of lift in unsteady flow is one utilizing a small disturbance of linearized concept. An approach to large order oscillating incompressible two dimensional lift is presented. The basic procedure is that of Theodorsen, with the exception of relaxed boundary conditions, generalized to permit large unsteady horizontal and angular perturbations. While the resulting non-circulatory lift term is but little changed, the circulatory lift expression is found to contain an additional term reflecting large unsteady effects. Given a combined translation and pitch oscillation, the additional term significance, sensitive primarily to the reduced frequency and the unsteady flow magnitude, will reflect loads larger or smaller than those predicted by linearized treatment, depending on the phase relationship of the unsteady flows. A numerical example is given. Author (USGRDR)

N70-10346# Sandia Corp., Albuquerque, N. Mex.
EXPERIMENTAL INVESTIGATION OF THE AERODYNAMIC CHARACTERISTICS OF A SPHERE IN FREE FLIGHT AT MACH NUMBER UP TO APPROXIMATELY 15 [EKSPERIMENTALNOE ISSLEDOVANIE AERODINAMICHESKIKH KHARAKTERISTIK SHARA V SVOBODNOM POLETE DO CHISEL M-15]
A. P. Krasilshchikov et al 20 Jun. 1969 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 4, Jul.–Aug. 1968 p 190–193 Sponsored by AEC
(PB-184636T; SC-T-69-1028) Avail: CFSTI CSCL 01A

The paper presents the results of several tests performed with a sphere in free flight within an aeroballistic tube, when the Mach numbers fluctuated between M = 1.5 and 15.2, while the fluctuation of the Reynolds numbers took place between 1,000,000 and 20,000,000. The study yielded data as to the coefficient of resistance, the departure of the shock, the radius values of the curvature of the shock wave in the area of the critical point of the sphere, and the form of the shock wave. Author (USGRDR)

N70-10426*# National Aeronautics and Space Administration, Washington, D.C.
COMPRESSIBLE TURBULENT BOUNDARY LAYERS
1969 572 p refs Held at Hampton, Va., 10–11 Dec. 1968
(NASA-SP-216) Avail: CFSTI CSCL 01A

Presented are various studies on compressible boundary layers and their skin friction, heating, profiles, and other characteristics at high speeds. Emphasis is placed on performance prediction methods. For individual titles see N70-10426 through N70-10446.

N70-10436*# National Aeronautics and Space Administration. Ames Research Center, Moffet Field, Calif.
SUMMARY AND CORRELATION OF SKIN-FRICTION AND HEAT-TRANSFER DATA FOR A HYPERSONIC TURBULENT BOUNDARY LAYER ON SIMPLE SHAPES
Edward J. Hopkins, Morris W. Rubesin, Mamoru Inouye, Earl R. Keener, George C. Mateer et al *In its* Compressible Turbulent Boundary Layers 1969 p 319–344 refs (See N70-10426 01-01)
(NASA-TN-D-5089) Avail: CFSTI CSCL 01A

Local skin-friction and heat-transfer data were directly measured in air of turbulent boundary layers on flat plates, cones, and a wind-tunnel wall. The Mach number at the edge of the boundary layer ranged between 5 and 7.4 and the wall to adiabatic wall temperature ratio varied between 0.1 and 0.6. The skin-friction and heat-transfer data are compared with other data obtained by direct measurement of surface shear with balances and accompanied by boundary-layer surveys. The use of momentum-thickness Reynolds number in the skin-friction comparison avoids the need for arbitrary location of the virtual origin of the turbulent boundary layer. A boundary-layer energy thickness obtained from integration of the heat-flux distribution up to a test station proved useful in correlating the local heat flux at that

station in a manner analogous to the use of momentum thickness. Adiabatic and cold wall data are employed to assess four theories for predicting turbulent skin friction. The theories examined are those of Sommer and Short, Spalding and Chi, Van Driest II, and Coles. Author

N70-10437*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va.

COMPARISON OF PREDICTION METHODS AND STUDIES OF RELAXATION IN HYPERSONIC TURBULENT NOZZLE-WALL BOUNDARY LAYERS

Dennis M. Bushnell, Charles B. Johnson, William D. Harvey, and William V. Feller *In its* Compressible Turbulent Boundary Layers 1969 p 345-376 refs (See N70-10426 01-01)
(NASA-TN-D-5433) Avail: CFSTI CSCL 01A

Recent turbulent boundary-layer measurements on axisymmetric nozzle walls at Mach numbers of 6, 8, and 19 are presented and compared with the predictions of two theoretical methods. One of the methods was of the integral type; the other was a finite-difference solution to the governing differential equations. The integral method gave good predictions of the data at Mach 6 and 8 and a reasonable prediction at Mach 19. Results for the finite-difference approach were available only at Mach 8, for which good agreement with data was obtained. A survey of boundary-layer data indicates that the variation of total temperature with velocity for flat-plate type of flows can be represented within the scatter of the data by the linear Crocco relation, whereas for nozzle-wall flows, this relation is generally more nearly quadratic. A finite-difference solution for the Mach 8 nozzle-wall boundary layer resulted in a quadratic-type temperature-velocity relation in the strong favorable pressure-gradient region downstream of the throat. However, near the nozzle exit the theoretical solution tended to approach the linear variation of Crocco. Apparently, the observed quadratic variation in nozzle boundary layers can be at least partly accounted for by the pressure-gradient history of the flow. Profile measurements along a straight pipe extension downstream of the nozzle unit of the Mach 6 tunnel indicate that at a distance of the order of 60 boundary-layer thicknesses, the flow tended to relax toward the linear temperature-velocity variation. Author

N70-10438*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A COMMENT ON COMPARISON OF PREDICTION METHODS AND STUDIES OF RELAXATION IN HYPERSONIC TURBULENT BOUNDARY LAYERS

Robert A. Jones *In its* Compressible Turbulent Boundary Layers 1969 p 377-380 (See N70-10426 01-01)
Avail: CFSTI CSCL 01A

The mechanism which may account for at least a part of the difference between the linear velocity-temperature relationship generally found for flat-plate boundary layers and the more nearly second degree curve variation found for the Mach 6 tunnel wall data was studied on the flow in a stagnation chamber. Boundary-layer surveys were made at various longitudinal stations. Approximate stagnation conditions for the data presented were 450 F and 550 psig with a corresponding flow velocity in the stagnation chamber of 4.8 ft/sec. The results of a detailed total temperature survey in the stagnation chamber showed that the total temperature was uniform over the entire chamber except for the region very near the liner. In this region a rather large temperature deficiency existed. A crude mass flow calculation indicated that this lower temperature layer of air is "swallowed" by the boundary layer about half-way down the nozzle and in the test-section boundary layer at a position 172 inches downstream of the throat about half of the boundary layer could be influenced by the low temperature layer. A similar total-temperature distribution was found in the Mach 8 variable density tunnel. Author

N70-10439*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CROSSHATCHING

Howard K. Larson and Philip R. Nachtsheim *In its* Compressible Turbulent Boundary Layers 1969 p 381-388 refs (See N70-10426 01-01)
Avail: CFSTI CSCL 01A

The results of many theoretical and experimental studies aimed at explaining crosshatching were presented and two significant factors became apparent: (1) All the wind-tunnel models on which crosshatching had been observed had significant surface roughness on the ablated surface upstream of the crosshatched region; and (2) all the theoretical gasdynamic approaches to the explanation of the crosshatching phenomenon, with the exception of the approach presented in reference 5, were not coupled to the ablation process. In reference 5 the gasdynamics is coupled to the ablation process via a melt layer. Several right circular cones made of various types of Teflon were tested in the stream produced by a 4,000-pound-thrust model rocket engine fueled with gaseous hydrogen and liquid oxygen. Models were exposed to the stream for 3.5 seconds by means of a rapidly actuated flame shield. The minimum change in model radius occurred at the beginning of transition with the maximum change in radius occurring at the end of transition or the beginning of turbulent flow. This leads to the necked-down appearance of the models. The crosshatched pattern begins downstream of the "neck." Author

N70-10440*# Nielsen Engineering and Research Co., Palo Alto, Calif.

RECENT APPLICATIONS OF THE METHOD OF INTEGRAL RELATIONS TO TURBULENT BOUNDARY LAYERS WITH HEAT TRANSFER AND PRESSURE GRADIENTS

Jack N. Nielsen and Gary D. Kuhn *In* NASA, Washington Compressible Turbulent Boundary Layers 1969 p 389-410 refs (See N70-10426 01-01)
Avail: CFSTI CSCL 01A

The method of integral relations used extensively to study laminar boundary layers, attached and separated, has been extended to compressible turbulent boundary layers with heat transfer and pressure gradients. A brief outline is given of the method, which requires as its only empirical input an eddy-viscosity model. A computer program based on the method has been applied to three illustrative cases. In the first case it is shown that the variation of flat-plate skin-friction coefficient with Mach number and surface temperature is predicted well by the method. In the second case, one of interaction between a hypersonic flat-plate boundary layer and an oblique shock wave, fair to good agreement is obtained between experiment and theory. The third case involves hypersonic flow past an axisymmetric compression flare with appreciable pressure gradients normal to the flare surface. By adjusting the measurements for the normal pressure gradients, good agreement between boundary-layer theory and experiment is obtained. An engineering method of adjusting boundary-layer theory for the normal pressure gradients is also presented. Author

N70-10441*# Royal Aircraft Establishment, Bedford (England).

SOME RECENT WORK ON COMPRESSIBLE TURBULENT BOUNDARY LAYERS AND EXCRESCENCE DRAG

K. G. Winter and L. Gaudet *In* NASA, Washington Compressible Turbulent Boundary Layers 1969 p 411-435 refs (See N70-10426 01-01)
Avail: CFSTI CSCL 01A

The analysis, leading to a simple method of calculating skin friction and profiles, of boundary layer characteristics at high Reynolds number and Mach numbers between 0.2 and 2.8 measured on the sidewall of the 8ft × 8ft tunnel is described. An extension to include the effects of surface roughness is indicated. Some results are also given for the drag of discrete excrescences immersed in a turbulent boundary layer. Author

N70-10442*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DOWNSTREAM EFFECTS OF BOUNDARY-LAYER TRIPS IN HYPERSONIC FLOW
E. Leon Morrisette, David R. Stone, and Aubrey M. Cary, Jr. *In its* Compressible Turbulent Boundary Layers 1969 p 437-453 refs (See N70-10426 01-01)
Avail: CFSTI CSCL 01A

Flow-field and boundary-layer surveys (pitot and total temperature) are shown for flow downstream of spherical roughness trips on a flat plate at near-adiabatic wall conditions in Mach 8.5 flow. The trips are shown to cause large distortions of the flow field and outer portion of the boundary layer. A method for minimizing these distortions is suggested. The nature of the tripping mechanism is discussed. Spherical and air jet trips are compared, and surface heating downstream of both types is presented. Author

N70-10443*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MEASUREMENTS OF TURBULENT HEAT TRANSFER ON CONES AND SWEPT PLATES AT ANGLE OF ATTACK
Thomas E. Polek and George G. Mateer *In its* Compressible Turbulent Boundary Layers 1969 p 455-471 refs (See N70-10426 01-01)
Avail: CFSTI CSCL 01A

Heat transfer measurements are presented for cones (5 deg and 15 deg half angle) and swept flat plates (0 deg, 70 deg, 75 deg sweepback) at angle of attack having turbulent boundary layers resulting from natural transition. Results are for air at a Mach number of 7.4 and Reynolds numbers ranging from 3 million to 14 million. The ratio of model wall temperature to stream total temperature ranged from .3 to .4. Results for the cones indicate a moderate dependence of the ratio of heating rates on the surface distance. At angle of attack, heating rates to the windward ray of the cone are predictable by a theory based on calculated inviscid edge conditions. Heating rates on the windward ray of the cone were found to vary linearly with angle of attack. However, for the flat plates, the variation was nonlinear with angle of attack. The heating rates measured on the unswept, sharp plate establish an upper limit for the heating rates on both the sharp and blunt swept plates. Author

N70-10444*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A NOTE ON THE EFFECT OF REYNOLDS NUMBER ON THE HEATING OVER THE LEE SURFACE OF A DELTA WING AT MACH 6
Allen H. Whitehead, Jr. *In its* Compressible Turbulent Boundary Layers 1969 p 473-480 refs (See N70-10426 01-01)
Avail: CFSTI CSCL 01A

A model for the lee-surface flow field over a highly swept delta wing with a detached shock at a Mach number of 6 and angle of attack of 5 deg is presented. It is shown that the heating in the center-line region is large because of the presence of vortices on the upper surface. The effect of a variation in free-stream Reynolds number from about 2 million to 20 million, based on model length, on the lee-surface heating is investigated, and it is found that the maximum values of the Stanton number occur at the center line at the lower unit Reynolds numbers. These values are well above laminar flat-plate predictions and exceed all values found at zero angle of attack at a comparable Reynolds number. When the center-line region is fully turbulent, the surface heating across the span can be correlated in conical coordinates. No such correlation exists for the lower Reynolds number data. Author

N70-10445*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BOUNDARY LAYER AND STARTING PROBLEMS ON A SHORT AXISYMMETRIC SCRAMJET INLET
J. R. Henry, E. H. Andrews, Jr., S. Z. Pinckney, and C. R. McClinton *In its* Compressible Turbulent Boundary Layers 1969 p 481-508 refs (See N70-10426 01-01)
Avail: CFSTI CSCL 01A

Practical boundary layer problems encountered in the experimental development of the inlet are discussed. Early experimental investigations conducted at Mach 4 revealed an inlet starting problem. A subsequent investigation indicated that wall cooling had a favorable effect on starting. The results of in-house analytical and experimental investigations of the starting phenomena are summarized, and a summary of extensive starting investigations conducted on a revised inlet design is given. The results of the in-house investigations show that the boundary layer development along the inlet centerbody is predicted within engineering accuracy by an integral boundary layer prediction method developed in-house. The accuracy of prediction methods is still hampered by the inability to predict the location of transition, to compute accurately through the transition region, and to account correctly for trip losses. Author

N70-10446*# National Aeronautics and Space Administration. Ames Research Center, Moffet Field, Calif.
STUDIES OF THE INTERACTION OF A TURBULENT BOUNDARY LAYER AND A SHOCK WAVE AT MACH NUMBERS BETWEEN 2 AND 10
Earl C. Watson, William C. Rose, Shelby J. Morris, Jr., and William F. Gallo *In its* Compressible Turbulent Boundary Layers 1969 p 509-543 refs (See N70-10426 01-01)
Avail: CFSTI CSCL 01A

Interactions between a turbulent boundary layer and a shock wave in two-dimensional flow on a compression surface having nonadiabatic wall conditions have been studied at Mach numbers of 7 and 10. Similar interactions in axisymmetric flow at Mach numbers of about 3 and 4 with adiabatic wall conditions have also been studied. Results obtained from these investigations are presented in terms of the boundary-layer properties (momentum, displacement and velocity thicknesses), surface-pressure distributions, shock-wave structure, and incipient-separation criteria. Results of the two-dimensional studies include the effects of leading-edge bluntness on the boundary-layer properties and the shock structure for wall cooling with a ratio of wall-to-free-stream total temperature of about 0.3. The results obtained in the axisymmetric study include the effect of boundary-layer bleed in the region of the interaction. Author

N70-10606# Massachusetts Inst. of Tech., Cambridge. Fluid Dynamics Lab.
AN ANALYTIC SOLUTION FOR TWO- AND THREE-DIMENSIONAL WINGS IN GROUND EFFECT
Sheila E. Widnall and Timothy M. Barrows Jun. 1969 41 p refs
(AD-692562; Rept-69-1) Avail: CFSTI CSCL 13/8

The method of matched asymptotic expansions is applied to the problem of a ram wing of finite span in very close proximity to the ground. The general lifting surface problem is shown to be a direct problem, represented by a source-sink distribution on the upper surface of the wing and wake, with concentrated sources around the leading and side edges plus a separate confined channel flow region under the wing and wake. The two-dimensional flat plate airfoil is examined in detail and results for upper and lower surface pressure distribution and lift coefficient are compared with a numerical solution. A simple analytic solution is obtained for a flat wing with a straight trailing edge which has minimum induced drag. To lowest order, this optimally loaded wing is an elliptical wing with a lift distribution which is linear along the chord. The resultant total spanwise lift distribution is parabolic. An expression for the lift coefficient at small clearance and angle of attack, valid for moderate aspect ratio, is derived. The analytic

results are compared with numerical results from lifting surface theory for a wing in ground effect; reasonable agreement is obtained. Author (TAB)

N70-10547# Aeronautical Research Labs., Melbourne (Australia).
TWO DIMENSIONAL AEROFOILS AT TRANSONIC SPEEDS
N. Pollock Apr. 1969 32 p refs
(ARL/A-314) Avail: CFSTI

A broad background of transonic airfoil development and profitable lines for further investigation are presented. An intuitive rather than a theoretical or empirical approach based on a physical understanding of the transonic flows involved is examined briefly. Additional freedom in the selection of section shapes provided by using a trailing edge of finite thickness would permit sections with higher critical Mach numbers and improved supercritical characteristics to be designed. However, before any decision on the practicality of blunt trailing edged airfoils can be made more work on the reduction of two dimensional base drag is required. Author

N70-10577# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Inst. für Angewandte Gasdynamik.
THE INFLUENCE OF A DEFLECTED SPIKE ON THE AERODYNAMIC FORCES OF BLUNT-NOSE CYLINDERS AT HYPERSONIC MACH NUMBERS [DER EINFLUSS EINES AUSGELENKTEN ZENTRALSTIFTES AUF DIE AERODYNAMISCHEN BEIWERTE ROTATIONSSYMMETRISCHER HYPERSCHALLFLUGKOERPER]
W. Wyborny (Ph.D. Thesis–Aachen Univ.) Jun. 1969 121 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-37; DVL-881) Avail: CFSTI

The influence of spikes on the aerodynamic forces of blunt-nose cylinders was measured using a hypersonic gun tunnel, M = 8.75. Considering the magnitude of the normal forces obtained by small deflections of the spikes, it appeared that such a device may provide a suitable means for flight control. A simplified empirical method is developed and used to roughly calculate the aerodynamic forces and static moments created by deflected and non-deflected spikes. Author (ESRO)

N70-10600*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
INFLUENCE OF THE BLADE TIP CLEARANCE OF AN AXIAL FLOW COMPRESSOR ON ITS PARAMETERS
Stefan Szczecinski et al Washington, D.C. NASA Nov. 1969 9 p refs Transl. into ENGLISH from Tech. Lotnicza i Astronautyczna. v. 24, no. 4, 1969 p 9–12
(Contract NASw-1692)
(NASA-TT-F-12653) Avail: CFSTI CSCL 01A

Analysis of the problem of selecting the radial blade clearance in an axial flow compressor, with allowance for casing deformations and rotor displacements during operation is presented. Graphical results are given for the effects of the radial blade clearance on the isentropic efficiency of the compressor stage and on the air delivery from the compressor. Author

N70-10711*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYPERSONIC AERODYNAMIC CHARACTERISTICS OF TWO DELTA WING X-15 AIRPLANE CONFIGURATIONS
Theodore J. Goldberg, Jerry N. Hefner, and David R. Stone Washington Oct. 1969 104 p refs
(NASA-TN-D-5498; L-6489) Avail: CFSTI CSCL 01A

An investigation of the hypersonic aerodynamic characteristics of two delta wing X-15 research configurations was conducted at a Mach number of 6 and a Reynolds number of 2.71 × 10 to the 7th power per meter. Limited tests of one model were also made at a Mach number of 8. Results are presented to show the aerodynamic effects of wing geometry and longitudinal position, wing fins, nose cant, strakes, speed brakes, and a suspended test ramjet. The type of boundary layer ahead of the elevons was determined from oil flow studies of the separation boundaries with and without boundary layer trips. Experimental aerodynamic characteristics are compared with analytical estimates. Author

N70-10728# IIT Research Inst., Chicago, Ill.
PRELIMINARY STUDY OF A ROTOR DRIVEN BY LEADING EDGE BLOWING, PHASE 2 Final Report, 1 Aug. 1967–18 May 1968
Imants Reba Jan. 1969 62 p refs
(Contract DOT-7-35512)
(PB-185511; IITRI-J-6128-FR) Avail: CFSTI CSCL 01C

The report summarizes a preliminary experimental study of a new propeller concept. The propeller blades were symmetrical 33-percent-thick air foil sections. Rotational speed was provided by a sheet of air ejected through a spanwise slit cut near the leading edge. The study was performed at static conditions and at a velocity of advance of 28 fps. At dynamic conditions, this rotor produces higher thrust coefficients and operates at higher advance ratios than a conventional propeller. The presently encountered propulsive efficiencies are low, but an extrapolation of data indicates that at least in the range of low advance velocities the propulsive efficiency of a blown foil propeller may be comparable to that of conventional propeller. Author (USGRDR)

N70-10739# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Abteilung Aerodynamik.
OPERATIONAL V/STOL TRANSPORT AIRCRAFT Research Report, 1 Jan.–31 Jul. 1967 [OPERATIONELLES V/STOL-TRANSPORTFLUGZEUG Studienauftrag im Zeitraum 1. Januar–31. Juli 1967]
M. Lotz Sep. 1967 89 p refs In GERMAN
(Rept-67/13) Avail: CFSTI

Several problems connected with V/STOL aircraft landing and forward flight are discussed, which were studied by means of wind tunnel tests, including interference. The pressure distribution for supersonic aircraft wings was calculated by computer. Formulas frequently used in subsonic aerodynamics were also calculated for useful parameter ranges and the results tabulated. Other research was directed towards boundary layer, profile, and wing theory. ESRO

N70-10741# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Aachen (West Germany). Inst. für Theoretische Gasdynamik.
NEIGHBOURING SOLUTIONS FOR SHOCK-FREE, PLANE AND SUPERSONIC FLOWS [NACHBARLOESUNGEN VON STOSSFREIEN EBENEN UEBERSCHALLSTROEMUNGEN]
H. Sonn (Ph.D. Thesis–Vienna Univ., 1965) May 1969 87 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-27; DVL-859) Avail: CFSTI

An analytical theory of the steady isentropic plane supersonic flow is represented and is applied to the flow about an Oswatitsch biplane. By means of this theory it is possible to answer the question of the existence of shock-free neighbouring solutions in shock-free plane supersonic flow. The nonexistence of such neighbouring solutions can be proved in the special case of a biplane. Author (ESRO)

N70-10953# Nationaal Lucht-en Ruimtevaartlaboratorium, Amsterdam (Netherlands).
REPORT FOR THE YEAR 1968 [VERSLAG OVER HETJAAR 1968]
1968 87 p In DUTCH; ENGLISH summary
Avail: CFSTI

Applied aerodynamic research consisted of propulsion system simulations in wind tunnel tests using hydrogen peroxide engines

and studies and tests of guidance and control for ELDO launch vehicles. Theoretical and experimental work was carried out in aerodynamic pressure calculations and combustion processes of solid fuels. Load and fatigue tests on F28 wings continued as did the development of standard procedures for calculating complicated aircraft structures by means of finite element methods. A study was made on stress corrosion of titanium in corrosive environments. Part of the flight test program on Fokker F28 aircraft prototypes was carried out and studies in connection with speed ability of aircraft continued. Wind tunnel tests on future launch configurations for space flight continued together with preliminary design studies on a guided sounding rocket for astronomical observations. Other activities reported included data handling and computer mathematics and equipment developments for aerodynamic research. G.G.

N70-10987*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN APPROXIMATE SOLUTION OF ADDITIVE-DRAG COEFFICIENT AND MASS-FLOW RATIO FOR INLETS UTILIZING RIGHT CIRCULAR CONES AT ZERO ANGLE OF ATTACK

Vincent R. Mascitti Washington Nov. 1969 23 p refs

(NASA-TN-D-5537) Avail: CFSTI CSCL 01A

This paper presents an approximate solution of additive drag coefficient and mass flow ratio for inlets utilizing right circular cones at zero angle of attack. The results are in good agreement with the exact solution, especially at high Mach numbers and large cone half-angles. The present method uses the incompressible approximation of the conical flow field. This conical-flow-field approximation facilitates analytic integration of the pressures acting on the entering streamline. In addition, the flow field properties obtained by the approximation are in good agreement with the results of the exact solution and other approximate solutions. The largest deviation between the exact solution and the present solution of additive-drag coefficient was ~0.039. Author

N70-11035# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Inst. für Angewandte Gasdynamik.

ON THE ZERO-LIFT-WAVE-DRAG OF WINGS DEPENDING ON THE THICKNESS DISTRIBUTION AND PLANFORM [ZUM WELLENWIDERSTAND VON TRAGFLUEGELN IN ABHAENGIGKEIT VON DICKENVERTEILUNG UND GRUNDRISSFORM BEI NULLAUFTRIEB]

Reinhard Hilbig Jul. 1969 48 p refs In GERMAN; ENGLISH summary

(DLR-FB-69-42; DVL-886) Avail: CFSTI

The given theory is valid for subsonic leading edges of pointed wings and for a flow approximated by the linearized gas dynamic equation. The local planform of wings with the trailing edge normal to flight direction and its thickness-distribution are varied. The thickness ratio of all wings under consideration with equal volume has to be small. A second order approximation to calculate the wave drag for higher Mach numbers or a planform which no longer has a small aspect ratio is added to that of the area rule, valid in the lower supersonic region only. Analytical solutions and diagrams show a remarkable influence on the wave drag of chosen wing planforms and a lengthwise displacement of the small maximum thickness. This influence increases with increasing Mach number and aspect ratio. Examples of pronounced trends to wave drag reduction are of special interest. Author (ESRO)

N70-11094# Massachusetts Inst. of Tech., Cambridge. Acoustics and Vibration Lab.

TURBULENT BOUNDARY LAYER WALL PRESSURE FLUCTUATIONS ON SMOOTH AND ROUGH WALLS

William K. Blake Jan. 1969 108 p

(Contract N00014-67-A-0204-0002)

(AD-691292; TR-70208-1) Avail: CFSTI CSCL 20/4

Turbulent boundary layer wall pressure measurements were made with 'pinhole' microphones three times smaller (relative to boundary layer thickness) than microphones used in earlier work. The improved high frequency resolution permitted examination of the influence of high frequency eddies on smooth wall pressure statistics. It was found that the space-time decay rate is considerably higher than previously reported. Measurements of cross-spectral density made with 5 Hz band width filters disclosed low phase speeds at low frequency and small separation. Measurements were repeated on rough walls and parallels were drawn from knowledge of a smooth wall boundary layer structure to propose a structure for a rough wall boundary layer. The effect of independently varying roughness height and separation on the large and small scale turbulence structure was deduced from the measurements. It was found that roughness separation affected the very large scale structure, whereas the roughness height influenced the medium and very small scale turbulence. Author (TAB)

N70-11237# West Virginia Univ., Morgantown. Aerospace Engineering Dept.

EXPERIMENTAL STUDY OF ROTOR DOWNWASH IN GROUND EFFECT IN THE PRESENCE OF A STEP

David G. Shaffer and Richard E. Walters Apr. 1969 85 p refs

(Contract N00014-68-A-0512)

(AD-692488; TR-13) Avail: CFSTI CSCL 1/3

The purpose of the experimental study is to investigate various flow parameters in the plane of symmetry of the flow field produced by a 14 inch diameter, four bladed rotor centered at one rotor radius above a vertical step. The parameters under investigation are the pseudo two dimensional streamline pattern, the resultant flow angles, and the resultant velocities. The forces acting on the rotor are also under investigation. Author (TAB)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N70-10103*# Techtran Corp., Glen Burnie, Md.

SURVEY OF THE GROUND EFFECT OF V/STOL AIRCRAFTS WITH JET PROPULSION: REPORT OF LITERATURE [UEBERSICHT UEBER DEN BODENEFFEKT BEI STRAHLGESTUETZEN V/STOL: FLUGZEUGEN LITERATURBERICHT]

E. Schwantes Washington NASA Oct. 1969 28 p refs Transl. into ENGLISH from the German report

(Contract NASw-1695)

(NASA-TT-F-12573) Avail: CFSTI CSCL 01C

A tabular survey is presented of the results of 132 scientific reports on the ground effects with jet lift V/STOL aircrafts. The region of the deflected jet is described and the different test conditions are compiled. Author

N70-10392# Royal Aircraft Establishment, Farnborough (England).

APPLICATION OF THE ROOT-LOCUS METHOD TO AEROELASTICALLY COUPLED SYSTEMS

Peter Hamel Jun. 1969 40 p refs Transl. into ENGLISH from Jahrb. 1967 der WGLR (Ger.), p 350-362 Presented at Joint Ann. Meeting of WGLR/DGRR, Karlsruhe, West Ger., 3-6 Oct. 1967

(RAE-Lib-Trans-1389) Avail: CFSTI

The root-locus method was developed for stability analysis of feedback control systems. It is shown that the root-locus method can be applied to stability investigations of aircraft with aeroelastic feedback. The singularities of the performance function of the equivalent open loop, which determine the character of the root-locus branches, describe in combination with the root-locus gain the aeroelastic coupling involving rigid body and elastic body degrees of freedom. The root-locus method is applied to the longitudinal and lateral dynamics of a flight vehicle with flexible fuselage and wing. Singularities and the root-locus gain acquire simple physical meanings. Finally, the method is used for the stability analysis of a binary oscillatory wind tunnel balance. Author

N70-10501*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THREE-TRACK RUNWAY ELEVATION PROFILES MEASURED AT TWO UNITED STATES GOVERNMENT INSTALLATIONS
Garland J. Morris Washington Nov. 1969 53 p refs
(NASA-TN-D-5545; L-6909) Avail: CFSTI CSCL 01E

Tabulated and plotted data for three-track elevation profiles for two operational runways are given for use in studies concerning airplane response to and loads resulting from runway roughness. Author

N70-10689# Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Braunschweig (West Germany). Inst. für Flugführung.
THE EMPLOYMENT OF DETERMINATION EQUIPMENT AS AN AID IN STUDYING DISPLAY PROBLEMS IN A FLIGHT SIMULATOR [DER EINSATZ EINES DETERMINATIONSGERAETES BEI DER UNTERSUCHUNG VON ANZEIGEPROBLEMEN IM FLUGZEUGSIMULATOR]
Ralf Beyer, Hans-Dieter Schenk, and Eckhart Zietlow May 1969 30 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-35) Avail: CFSTI

In addition to investigations in the field of guidance technique and information theory, measurements and analyses in the physiological, biochemical and experimental-psychological area are part of human engineering investigations on information transmission in guidance systems. These measuring methods mainly serve to obtain an indirect determination of the psycho-mental stress of human beings in man-machine systems. For this purpose, the employment of determination equipment in a flight simulator is investigated and the results obtained are compared with the results of other measurements on man-machine systems. The comparison shows that the determination equipment in the flight simulator can be employed for the determination of varying attention and concentration requirements and may assume many other tasks in the case of man-machine investigations. Author (ESRO)

N70-10779*# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.
STUDIES IN FUNDAMENTAL CHEMISTRY OF FUEL CELL REACTIONS Quarterly Report, 1 Apr. - 30 Jun. 1969
John O'M. Bockris 30 Jun. 1969 51 p
(Grant NGR-39-010-002)
(NASA-CR-106638; QR-2) Avail: CFSTI CSCL 10B

The research developments in fuel cell chemistry are presented. Projects reported are: (1) theoretical study of electrocatalysis, (2) the study of dendritic deposition of zinc from alkaline solution, (3) reversibility of organic reactions, and (4) ellipsometric studies for ion adsorption on solid electrodes. F.O.S.

N70-10793# Arbeits- und Forschungsgemeinschaft Graf Zeppelin, Stuttgart (West Germany).
VISIBILITY PROBLEMS DURING BAD WEATHER LANDING IN CIVIL AVIATION [DAS PROBLEM DER SICHT BEI DER SCHLECHTWETTERLANDUNG IN DER ZIVILLUFTFAHRT]
Knut Krumeich 1969, 75 p refs In GERMAN Proc. of the 76th Space Meeting, Stuttgart, 13 May 1969
Avail: CFSTI

Requirements for visual landings are discussed, together with estimations by ground personnel and pilots of ground conditions. Devices to measure visibility of runway lights are described and infrared devices used as landing aids are investigated. ESRO

N70-10810# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Institut für Flugführung.
CONTRIBUTION TO THE ANALYTICAL DESIGN OF THE QUICKENED DISPLAY IN GUIDANCE SYSTEMS [BEITRAG ZUR ANALYTISCHEN BEHANDLUNG DER QUALITATIVEN VORAUSANZEIGE IN FUEHRUNGSSYSTEMEN
Ralf Beyer and Eckhart Zietlow Feb. 1969 58 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-30) Avail: CFSTI

The quickened display has proved its usefulness for stabilisation purposes, particularly in high order control systems, though only few systematical investigations and quantitative test results have become known so far. The design of quickened displays is based mainly on empirically determined fundamentals. Regarding the cost and time involved in the optimization process of a quickened display, it was considered useful to substitute the empirical investigation methods by a suitable analytical approach. Using a high order control system for demonstration, an appropriate analytical method is investigated and tested. The method has shown good results and proved its usefulness in designing a quickened display for a limited range of natural frequencies in the man-machine system tested. Author (ESRO)

N70-10872# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Inst. für Flugfuehrung.
A CONTRIBUTION TO THE CRITICAL EXAMINATION OF AIRCRAFT DISPLAYS IN GUIDANCE SYSTEMS [EIN BEITRAG ZUR BEWERTUNG VON ANZEIGEN IN FLUGFUEHRUNGSSYSTEMEN]
Ralf Beyer, Hans-Dieter Schenk, and Eckhart Zietlow May 1969 26 p refs In GERMAN; ENGLISH summary
(DLR-mitt-69-12) Avail: CFSTI

The optimum information exchange in man-machine-systems requires human factor engineered information displays and controls. As an example, the influence of two different aircraft displays on spatial orientation performance is investigated using a comparison of control engineering, experimental-psychological and physiological measurements. Flight simulator tests showed that aircraft displays having a uniform coordinate system seem to give a better spatial orientation performance than those displaying the same information in more than one coordinate system. This result is based mainly on the examination of the psychogalvanic reflex of the persons under test. Author (ESRO)

N70-11097# New York Univ., N.Y. Dept. of Aeronautics and Astronautics.
ON A CAUSE OF FAILURE OF HIGH ALTITUDE PLASTIC BALLOONS
Arnold D. Kerr and Harold Alexander Aug. 1968 27 p refs
(Contract F19628-67-C-0241)
(AD-692173; NYU-AA-68-28; SR-5; AFCRL-68-0488) Avail: CFSTI CSCL 1/3

In a search for causes of failure of plastic balloons, an experiment which simulates the stresses and temperatures in part of a balloon during launch and ascent was conceived and then tests using a number of balloon films were conducted. The test sample is a cylinder formed by heat sealing two long film strips along the edges. In the test the film cylinder, which is closed at both ends, is preloaded axially at a temperature encountered at launch, after a time interval cooled to -70F, and then pressurized until

it bursts. Tests were conducted on samples made of StratoFilm 54 inch layflat tubes, DFD-5500 54 inch layflat tubes and DFD-5500 33 inch layflat tubes. All tested films were 2 mils thick. Author (TAB)

N70-11174# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: NORTH CENTRAL AIRLINES, INC. CONVAIR 580, N4634S, HOME AIRMOTIVE, INC. CESSNA 150, N8742S MIDAIR COLLISION NEAR MILWAUKEE, WISCONSIN, 4 AUGUST 1968
8 Jul. 1969 51 p refs *Its* File 1-0011
(PB-185472; SA-405) Avail: CFSTI CSCL 01B

The National Transportation Safety Board determined that the probable cause of the accident was the inability of the Convair 580 flightcrew to detect the Cessna 150 visually in sufficient time to take evasive action, despite having been provided with three radar traffic advisories concerning the latter aircraft. Visual detection capabilities were substantially reduced by the heavy accumulation of insect smears on the forward windshield and direct vision windows of the Convair. Visibility was further reduced by haze, smoke and sun glare, and by the inconspicuous color and lack of relative motion of the Cessna. Under these circumstances, the crew of the Convair should have requested a radar avoidance vector. Author (USGRDR)

N70-11178# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AERODYNAMICS OF THE MI-4 HELICOPTER
M. S. Yatsunovich 13 Mar. 1969 380 p refs Transl. into ENGLISH of the book 'Aerodinamika Vertoleta MI-4' Moscow, 1967 p 1–280
(AD-691915; FTD-MT-23-449-68) Avail: CFSTI CSCL 01/3

The report describes the aerodynamics of single-rotor helicopters. The practical aerodynamics of the Mi-4 Helicopter are analyzed. The rotor is analyzed in detail as well as flight conditions and other aerodynamic characteristics. Author (TAB)

N70-11250*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DIRECT LIFT CONTROL SYSTEM Patent Application
Howard J. Osborne, inventor (to NASA) Filed 20 Jun. 1969 8 p
(NASA-Case-LAR-10249-1; US-Patent-Appl-SN-835080) Avail: CFSTI CSCL 01C

A direct lift control system, which is associated with existing control mechanism on most aircraft, is described. This is accomplished by forming a slot through the flap associated with the wing. When the flap is deflected, air is forced through the slot opening in the lower surface of the flap and discharged at the slot opening at the upper surface of the flap and spoils the airflow over the flap thus reducing lift. Tests have shown that this arrangement has little effect on drag, since the actual shape of the airfoil flap combination has not been changed to any degree. There are, in addition, various means with which to control the slot width that will require only small forces for operation. It is believed that direct lift control is provided which may be utilized on all aircraft, with particular application to lightweight aircraft. NASA

N70-11289# Idealab, Inc., Franklin, Mass.
AIRCRAFT INTERFEROMETER DEVELOPMENT Final Report, 1 May 1968–30 Nov. 1968
Alvan H. Bullard Apr. 1969 37 p
(Contract AF 19(628)-5994)
(AD-692518; AFCRL-69-0238) Avail: CFSTI CSCL 01/3

In this report the special features of the three interferometers flown successfully in a KC-135 aircraft are discussed. The vibration disturbance in the aircraft required that the interferometer servo be made 'stiffer'. The steps taken to accomplish this are presented. The special shaker table used to check the interferometer for its vibration sensitivity is described. Author (TAB)

N70-11388# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT: BRANIFF AIRWAYS, INC., LOCKHEED L-188 N9707C NEAR DAWSON, TEXAS, 3 MAY 1968
19 Jun. 1969 710 p refs *Its* File 1-0003
(PB-185254; SA-403) Avail: CFSTI CSCL 01B

A Braniff Airways, Inc., Lockheed L-188, N9707C, operating as Flight 352 between Houston and Dallas, Texas, crashed approximately 1 mile east of Dawson, Texas, about 1648 c.d.t., May 3, 1968. The 80 passengers and 5 crewmembers aboard the aircraft died in the accident, and the aircraft was destroyed. The report documents the accident investigation and gives the NTSB conclusions and recommendations. USGRDR

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N70-10382# Army Foreign Science and Technology Center, Washington, D.C.
PERFORMANCE OF NICKEL-IRON CELLS OPERATING UNDER PULSE CONDITIONS
K. K. Rashevits 1968 16 p refs Transl. into ENGLISH from Latasar Izv. Ser. Fiz. i Tekhni Cheskikh (Riga), no. 5, 1967 p 119–126
(AD-692361; FSTC-HT-23-625-68) Avail: CFSTI CSCL 10/3

Transient processes and operating charecteristics of nickel-iron cells under pulse-loads are examined. Author (TAB)

N70-10447# Army Electronics Command, Fort Monmouth, N.J.
FAST TRANSIENT RESPONSE FUEL CELL-BATTERY HYBRID POWER SOURCE
Galen R. Frysinger Jan. 1969 5 p refs Presented at the Intern. Automotive Eng. Congr., Detroit, 13-17 Jan. 1969
(AD-692538) Avail: CFSTI CSCL 10/2

The integration of a molten carbonate fuel cell with a molten electrolyte battery both electrically and thermally produces a highly efficient power source with a fast transient response. Since most practical high pulse applications utilize electronic chopping circuits, microsecond and millisecond response characteristics of a power source are of importance. Ceramic monoblock construction of a hybrid package can be designed with optimum response characteristics as well as the ability to accept high reverse power flow. Author (TAB)

N70-10482*# Yardney Electric Corp., New York.
DEVELOPMENT OF A 300 AH RESERVE SILVER ZINC CELL FOR AUTOMATICALLY ACTIVATED BATTERY Quarterly Report, Jul.–Sep. 1969
J. R. Szenyi Oct. 1969 18 p
(Contract NAS5-21057)
(NASA-CR-106582; QR-1) Avail: CFSTI CSCL 10C

The purpose of this work is to design and develop an automatically activated single cell- silver-zinc battery, with a nominal

capacity of approximately 300 Ah, for deep space exploration. During the period covered by this report, the following has been accomplished: (1) a preliminary design, for both dry charged and unformed cells has been made; (2) six cells of the above design (3 of each type) have been built and testing started; (3) eight cells of similar design, but scaled down to approximately 5 Ah size were also built. Six of these cells were provided with pressure gauges and gas evacuation fittings. Initial tests results on these cells are also available; and (4) an activation system has been devised and will be ready for testing shortly. Author

N70-10468*# Philco-Ford Corp., Palo Alto, Calif. Space and Re-Entry Systems Div.

FLIGHT DATA ANALYSIS OF POWER SUBSYSTEM DEGRADATION AT NEAR SYNCHRONOUS ALTITUDE Quarterly Report

R. J. Grant, W. T. Picciano, and R. A. Reitman 3 Oct. 1969 97 p
(Contract NASw-1876)
(NASA-CR-106529; TN-DA2124; QR-1) Avail: CFSTI CSCL 10B

The primary objectives of this program are: to establish the quantitative degradation rates of the power subsystems of seventeen IDSCS spacecraft in near-synchronous orbit, to investigate the degradation of the I-V characteristics of their solar arrays, to investigate any anomalistic or unexpected behavior relating to environmental damage, and to analyze all results such that the benefits of this flight experience can be applied to other current and future programs. Based on an average assumed single cell I-V characteristic, the undegraded theoretical satellite array I-V characteristic is determined as a function of time. Telemetry data monitoring the power subsystem provides two points on the array I-V curve. The difference between the calculated and observed values of current and voltage output at these two load points produces a quantitative measure of array degradation as a function of time. A further refinement of this difference data can be carried out with the sophisticated computer techniques developed for this program. Author

N70-10725*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A PROPORTIONAL FLUID JET AMPLIFIER WITH FLAT SATURATION AND ITS APPLICATION TO GAIN BLOCKS

William S. Griffin and Vernon D. Gebben Washington Nov. 1969 31 p refs
(NASA-TM-X-1915; E-5157) Avail: CFSTI CSCL 20D

A proportional fluid amplifier which exhibits flat saturation and a pressure gain greater than 6 has been developed. Three amplifiers were connected in series to form an open-loop gain block. The output of the gain block did not decrease below 95 percent of its maximum value for input signals ranging from those just sufficient to cause saturation to those 20 times that value. The performance was limited by zero changes and gain variations, both resulting from pressure level changes in the control ports. Author

N70-10746*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL EVALUATION OF A 3.50-INCH RADIAL TURBINE DESIGNED FOR A 10-KILOWATT SPACE POWER SYSTEM

Milton G. Kofskey and Charles A. Wasserbauer Washington Nov. 1969 19 p refs
(NASA-TN-D-5550) Avail: CFSTI CSCL 10A

Tests were conducted in argon at the Reynolds number of 109 000 and over a range of Reynolds number from 68 900 to 219 900. Performance results at design Reynolds number are presented in terms of equivalent specific work, torque, mass flow rate, and efficiency for a range of speeds and pressure ratios. A comparison of turbine efficiency is made with radial inflow turbines having tip diameters of 6.02 in. and 4.59 in. which were geometrically similar to the 3.50 in. diameter turbine. Author

N70-10898*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

THERMALLY CASCADED THERMOELECTRIC GENERATOR Patent Application

Robert Flaherty, inventor (to NASA) Filed 24 Jul. 1969 22 p
(Contract NAS7-100)
(NASA-Case-NPO-10753; US-Patent-Appl-SN-844355) Avail: CFSTI CSCL 10A

A thermally cascaded thermoelectric generator is disclosed. The generator includes a first stage containing high-temperature thermoelectric elements and a second stage containing lower temperature thermoelectric elements. The stages are connected in thermal series by means of an elongated heat transfer pipe containing a liquid metal and a wick. A portion of the heat radiated to the first stage from a high-temperature radioisotope source is converted to electricity. The heat rejected by the first stage is conducted to the heat pipe and absorbed by the liquid metal as latent heat of vaporization. The vapor rises to the second stage and condenses to give up latent heat of condensation which is transferred to the second stage and is converted to electricity therein. The condensed liquid returns on the wick to the vicinity of the first stage. NASA

N70-11022*# General Electric Co., Philadelphia, Pa. Re-Entry and Environmental Systems Div.

THE BIOSATELLITE FUEL CELL/BATTERY POWER SYSTEM

Alfred C. Bruhin and Charles W. Bennett 1969 23 p
(Contract NAS2-1900)
(NASA-CR-73378) Avail: CFSTI CSCL 10B

A power system was developed for the Biosatellite spacecraft which utilizes a hydrogen-oxygen fuel cell/silver-zinc battery combination to supply the mission electrical power. This system provides emergency modes of operation and insures uninterrupted power to the payload. A novel power controller was developed incorporating the capability of providing both peak load sharing and emergency power transfer in the event of a power source failure. Development programs were initiated with results in a fuel cell technology capable of providing hardware for aerospace missions in excess of 5000 hours, and a Ag-Zn battery with a 60 day life and an energy density of 95 watt-hours/pound. The original trade-off procedures used to select the optimum power system design was discussed. Author

N70-11081# British Aircraft Corp., Filton (England). Guided Weapons Div.

A STUDY OF ADVANCED SOLAR ARRAY DESIGN Quarterly Report, 1 Feb. – 30 Apr. 1969

D. W. Mann comp. and K. K. Reinhartz comp. Jun. 1969 78 p refs Sponsored by ESRO Prepared jointly with E. Turner (Elec. Instr.) Ltd.
(Contract ESTEC-623/68sl)
(ESRO-CR-7; QR-1) Avail: CFSTI

This report covers the first quarter of the ESRO contract 'A Study of Advanced Solar Array Design' and discusses the combined work of the British Aircraft Corporation Limited and their associated sub-contractor Ernest Turner (Electrical Instruments) Ltd. The first period has been used for initial system studies and for materials testing. Consideration has been given to the design and development of a flexible, rolled-up solar array; a solution to the problem offering in the opinion of the authors, the greatest potential in achieving high power-to-weight ratios. Author (ESRO)

N70-11085*# Honeywell, Inc., Hopkins, Minn. Ordnance Div.
CONVERSION: REGULATION FROM UNCONVENTIONAL PRIMARY AND SECONDARY SOURCES Final Report, 23 Jun. 1967 – 23 Jun. 1969
Jun. 1969 113 p refs
(Contract NAS5-10440)
(NASA-CR-106658) Avail: CFSTI CSCL 10B

Several systems approaches were examined for development of a power conditioner of minimum size and weight which will derive power from a radioisotopic thermoelectric generator (RTG). In addition, it must maintain high performance over a variable load profile, while efficiently converting the low RTG voltage to a higher level. The system selected consists of two separately powered inverters, whose outputs are connected in parallel. These outputs are in turn connected to a single-output voltage regulator. This configuration is the least complex and most reliable of designs considered for the wide operating ranges required for a three-year space mission. Problems encountered due to system transients created by operation of the RTG overvoltage protection circuit, causing unstable performance, were overcome. Significant achievements during the reporting period include development of a stable voltage regulator; two unique low-loss methods for sensing current in a pulse width modulated system; and a simple system for using secondary current feedback for transistor drive in an inverter. A.C.R.

N70-11301# European Space Research Organization, Paris (France).
PROCEEDINGS OF THE SIXTH ESRO SUMMER SCHOOL, VOLUME 6: SPACE POWER SYSTEMS: INTRODUCTION
Jul. 1969 108 p refs Partly in FRENCH and partly in ENGLISH
Conf. held at Noordwijk, Neth., 1968
(ESRO-SP-45) Avail: CFSTI

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3. ISOTOPIC ENERGY SOURCES H. Daspet (CNES, Brétigny) p 57–78 refs (See N70-11304 01-03)
4. NUCLEAR REACTORS AS A SOURCE OF POWER IN SPACE L. R. Shepherd (Atomic Energy Estab., Winfrith) p 79–108 refs (See N70-11305 01-03)

N70-11302# European Space Research and Technology Center, Noordwijk (Netherlands).
SPACE MISSION AND POWER SUPPLY REQUIREMENTS
K. H. Heffels *In* ESRO Proc. of the 6th ESRO Summer School, Vol. 6: Space Power Systems: Introduction Jul. 1969 p 1–23 refs (See N70-11301 01-03)
Avail: CFSTI

First a short description of passive spacecraft and power needs in sounding rocket experiments is presented. This is followed by a comparison of the electric power needed in active satellites for telecommunication, for motion control and stabilisation, and for payloads. Typical examples are given, including weight and power breakdown, of a few satellites built and studied at ESTEC. Future power demands of European spacecraft are also considered. Author (ESRO)

N70-11303# European Space Research and Technology Center, Noordwijk (Netherlands).
PRIMARY ENERGY SOURCES AND CONVERSION SYSTEMS
K. H. Heffels *In* ESRO Proc. of the 6th ESRO Summer School, Vol. 6: Space Power Systems: Introduction Jul. 1969 p 25–56 refs (See N70-11301 01-03)
Avail: CFSTI

This report discusses solar, chemical and nuclear energy as energy sources for space power systems. A short description of the principles, problems and the present development status of solar cells, thermoelectric and thermionic converters, heat engines, primary batteries and fuel cells is given. A brief discussion of combinations of energy sources and converters is included. Author (ESRO)

N70-11304# Centre National d'Etudes Spatiales, Brétigny-sur-Orge (France).
ISOTOPIC ENERGY SOURCES [LES SOURCES D'ENERGIE ISOTOPIQUE]
H. Daspet *In* ESRO Proc. of the 6th ESRO Summer School, Vol. 6: Space Power Systems: Introduction Jul. 1969 p 57–78 refs In FRENCH (See N70-11301 01-03)
Avail: CFSTI

After describing two kinds of energy sources the even-SNAP (fission) and the uneven SNAP (radio-active decay) the specific power of uneven SNAP and also conditions which the radio element must satisfy (cost, toxicity, life) are analyzed. Peltier and Thomson effects are discussed and the actual efficiency of the thermoelectric conversion is calculated. General characteristics of thermoelectric generators, of which SNAP is an example, lead to the conclusion that these devices are very suitable for long duration missions or for missions in shaded regions. The high cost of radioactive isotopes however will plead the case for use of solar generators for the missions which are at present envisaged. ESRO

N70-11305# Atomic Energy Establishment, Winfrith (England).
NUCLEAR REACTORS AS A SOURCE OF POWER IN SPACE
L. R. Shepherd *In* ESRO Proc. of the 6th ESRO Summer School, Vol. 6: Space Power Systems: Introduction Jul. 1969 p 79–108 refs (See N70-11301 01-03)
Avail: CFSTI

Three methods exist for converting the power generated in nuclear energy sources: the direct, the quasi-direct, and the indirect (or dynamic) methods. The direct method does not seem to be applicable to nuclear fission and is not discussed. The quasi-direct and indirect systems both work according to a thermodynamic cycle, but differ in that the quasi-direct system, using electrons for its working fluid, requires no moving parts, whereas the indirect system uses a material working fluid and thus needs rotating machinery. Indirect systems are discussed first and the use of conventional turbines considered. According to the level of power required, three possible arrangements are retained: a mercury Rankine cycle, noble-gas cycles, and MPD generators. Quasi-direct conversion is next discussed. The in-pile thermionic converter seems to be the most promising system for low-power ranges. In conjunction with the various conversion methods discussed, two types of moderated reactors are analysed, one employing graphite moderation and appropriate to the dynamic system, the other employing hydrogen or beryllium and appropriate to thermionic power conversion. It is concluded that the thermionic system, based on hydride-moderated reactors, could be designed with total mass of approximately one tonne and therefore suitable for a European launcher. As an alternative, a hybrid carbon/hydride reactor system with a gas turbine power cycle might be considered, while at very high power outputs the dynamic system might be more appropriate. Author (ESRO)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N70-10001*# Minnesota Univ., Minneapolis. College of Medical Sciences.
DEVELOPMENT AND EVALUATION OF AN IMPEDANCE CARDIOGRAPHIC SYSTEM TO MEASURE CARDIAC OUTPUT AND OTHER CARDIAC PARAMETERS, 1 JULY 1968 – 30 JUNE 1969
William G. Kubicek, D. A. Witsoe, R. P. Patterson, and A. H. L. From 30 Jun. 1969 465 p refs Presented at 1st Symp. on Impedance Cardiography, Houston, Tex., 2 – 4 Jun. 1969
(Contract NAS9-4500)
(NASA-CR-101965) Avail: CFSTI CSCL 06E

The papers presented pertain to the development of a noninvasive method to assess cardiac function and other parameters of the cardiovascular system. For individual titles, see N70-10001 through N70-10025.

N70-10004*# Cornell Univ., New York. Dept. of Surgery.
THE USE OF THE IMPEDANCE CARDIOGRAPH IN ASSESSING THE HUMAN CARDIAC TRANSPLANT
Robert L. Kaster, C. Walton Lillehei, and Peter J. Starek *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 43 – 66 refs (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

Experience with impedance cardiography in detecting subclinical cardiac rejection is reviewed, and the monitoring technique is described in detail. Two cardiac transplant patients were studied using the cardiograph intermittently over periods of two and three months respectively. Results for each patient are given, and it is reported that four additional cases were selected for further evaluation of the instrument following this initial study, with specific changes in technique being initiated with them. From all of the studies, it is concluded that reliable and reproducible records can be obtained provided a thorough understanding of the instrument and a certain operative efficiency is achieved. In addition, it is felt that impedance cardiography may lead to understanding of other intracorporeal disturbances through improved techniques of data analysis. A.C.R.

N70-10006*# Walter Reed Army Medical Center, Washington, D.C. Div. of Surgery.
ALTERATIONS IN TRANSTHORACIC ELECTRICAL IMPEDANCE WITH ACUTE INTRAVASCULAR OVERLOAD
Irwin J. Berman, Walter L. Scheetz, Edward B. Jenkins, and Howard V. Hufnagel *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 78 – 98 refs (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

An experiment with dogs is reported which was designed to determine changes in transthoracic electrical impedance that accompany intravenous overinfusion and pulmonary edema and to relate these changes to certain hemodynamic factors in control animals and in experimental models of hemorrhagic and septic shock. Emphasis was placed upon establishing the relationship between transthoracic impedance and conventional measurements which are used in the care of critically ill patients. Fall in the transthoracic impedance is accompanied by elevated cardiac output, fall in peripheral resistance, and peripheral and pulmonary arteriovenous shunting. Impedance changes may occur as the result of increased conductivity due to decreased intrapulmonary aeration or to increased intrathoracic fluid volume. Differentiation between intravascular and extravascular volume was not possible. Author

N70-10008*# Albert Einstein Coll. of Medicine, New York.
CLINICAL AND EXPERIMENTAL USE OF THORACIC IMPEDANCE PLETHYSMOGRAPHY IN QUANTIFYING MYOCARDIAL CONTRACTILITY
John H. Siegel, Miklos Fabian, Charles Lankau, Michael Levine, Andrew Cole et al *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 103 – 141 refs (See N70-10001 01-04)
(Grants HE-10033; HE-10415)
Avail: CFSTI CSCL 06E

Measurements on high risk patients and on anesthetized dogs to determine cardiac output by thoracic impedance plethysmography are described. Apetic and intraventricular pressures, the first derivative of the intraventricular pressure pulse, changes in impedance, and the first derivative of the impedance curve were obtained. Myocardial isometric time – tension relations and myocardial force – velocity relations were established and are discussed, and data are graphed. It is felt that thoracic impedance pulse evaluation permits determination of the basic myocardial contractile state and the response of cardiac inotropic agents. N.E.N.

N70-10009*# Iowa Univ., Iowa City. Dept. of Pediatrics.
THE FIRST DERIVATIVE THORACIC IMPEDANCE CARDIOGRAM: A USEFUL SIGNAL FOR TIMING EVENTS IN THE CARDIAC CYCLE
Zudhi Lababidi, D. A. Ehmke, Robert E. Durnin, Paul E. Leaverton, and Ronald M. Lauer *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 142 – 161 refs (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

When an alternating current of high frequency is applied to the thorax, the first derivative of the impedance to this current is affected by the volumetric changes occurring during the cardiac cycle. Phonocardiograms, ECG's and first derivative impedance cardiograms (ICG) were recorded simultaneously in 91 subjects. The ICG's were found to have sharply demarcated points which occur synchronously with the first heart sound, aortic second sound, pulmonic second sound, mitral opening snap, third heart sound and fourth heart sound. The ICG may thus be used not only as a reference tracing to help identify heart sounds on the phonocardiogram, but also to directly time intervals within the cardiac cycle. Clinically it proved to be useful in measuring the split of the second heart sound, recognizing the third and fourth systolic valves, mitral opening snaps, systolic ejection clicks on the phonocardiogram, and identifying P waves in ECG's showing arrhythmia. Author

N70-10010*# Minnesota Univ., Minneapolis. Medical School.
PHYSIOLOGICAL CORRELATES OF THE CARDIAC THORACIC IMPEDANCE WAVEFORM
James N. Karnegis and William G. Kubicek *In its* Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 162 – 174 refs (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

Experimental results are described to correlate the impedance waveform deflections with physiological events. Four circular, flexible, metallic electrodes were used, two around the neck and two around the upper abdomen of the patient. An activating 6 ma, 100 kc sinusoidal current was passed through the outer two electrodes from a constant current source, and pulsatile changes in the thoracic impedance, related to the beating of the heart, were recorded. An increase in impedance is associated with atrial contraction and consistently follows the P wave of the electrocardiogram. Two other waves show a decrease in impedance. The first is associated with ventricular systole and corresponds in time with the QRS complex of the electrocardiogram. The systolic wave is then followed by the third component, which also shows a decrease in impedance but occurs in diastole. In instances of arrhythmias the deflection associated with the P wave occurs

independently of the other two deflections. The impedance change waveform is similar to the pattern of blood flow in the venae cavae and the pulmonary veins. Author

N70-10011*# Utah Univ., Salt Lake City. Dept. of Biophysics.
COMPARISON OF METHODS FOR CALCULATING STROKE VOLUME FROM AORTIC PRESSURE AND IMPEDANCE CARDIOGRAPH
W. Sanford Topham and Homer R. Warner *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 175–185 refs (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

The accuracy and feasibility of using the impedance cardiograph to calculate central blood flow using noninvasive methods was studied first on dogs, and then on human subjects. Beat by beat comparison was made between stroke volume calculated by computer from pressure pulse, and stroke volume was calculated by the impedance cardiograph. With the normal human subject, an 18 gauge needle was inserted into the radial artery. Through this needle a catheter was inserted to the aortic arch. In a supine position, he exercised for two to three minutes using an exercycle. The control and after exercise waveforms of the EKG, PP, and dz/dt are presented. It is concluded that: the correlations from the dog are better than those for humans, and it is impractical to make beat by beat calculations for monitoring humans by this method. F.O.S.

N70-10012*# Minnesota Univ., Minneapolis. Dept. of Physical Medicine.
THE DEVELOPMENT OF A TRANSFER FUNCTION BETWEEN AORTIC BLOOD FLOW AND THE FIRST DERIVATIVE OF THE THORACIC IMPEDANCE
Robert P. Patterson, David A. Witsoe, A. H. L. Fromm, and William G. Kubicek *In its* Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 186–202 refs (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

The technique for calculating stroke volume from thoracic impedance measurement used for finding the transfer function between the aortic blood flow and the first derivative of the thoracic impedance signal is described. The transfer function was developed by taking the Fourier series for both the impedance derivative signal with the diastolic portion set equal to zero, and the aorta flow signal. It is concluded that the transformed impedance signal improves the reliability of the thoracic impedance signal in determining change in stroke volume. F.O.S.

N70-10013*# Duke Univ., Durham, N.C. Dept. of Medicine.
EVALUATION OF THORACIC IMPEDANCE PLETHYSMOGRAPHY AS AN INDICATOR OF STROKE VOLUME IN MAN
Robert J. Bache, Alexander Harley, and Joseph C. Greenfield *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 203–235 refs Sponsored in part by N.C. Heart Assoc. (See N70-10001 01-04)
(Grant HE-09711)
Avail: CFSTI CSCL 06E

The maximum negative first derivative of the systolic thoracic impedance change, and duration of ejection were measured in 8 patients with cardiomegaly, while stroke volume was computed continuously using the pressure gradient technique. Wide variations in heart rate and stroke volume were produced by atrial pacing, as pulsus alternans occurred spontaneously. Duration of ejection showed a close curvilinear relationship with stroke volume expressed as a logarithmic function which was similar for all patients. A linear relationship existed between the maximum impedance derivative and stroke volume which was close in some patients but was poor or varied with heart rate in others. No independent characteristic was found to predict in which patients the maximum impedance derivative reliably reflected changes in stroke volume. Wide variations in this relationship between individuals prevented its satisfactory description for all patients by any single equation. Author

N70-10014*# Florida Univ., Gainesville. Div. of Cardiology.
STUDIES USING THE IMPEDANCE CARDIOGRAPH AS A POTENTIAL MONITOR DURING TREATMENT OF ACUTE DISSECTING ANEURYSMS
R. S. Elliot, Howard W. Ramsey, R. F. Palmer, and E. K. Prokop *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 236–246 refs (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

The purpose of this study was to attempt to correlate the impedance output, dz/dt, with the cardiac parameters dP/dt sub max and contractility. dP/dt sub max (in the ascending aorta) and the impedance output, dZ/dt were recorded output, dZ/dt were recorded before and after Isuprel administration in humans. The mean ratio dP/dt sub max dP/dt sub max after and before Isuprel administration was 2.0. The mean ratio for dZ/dt under the same conditions was 1.7. The impedance cardiograph was then used on dogs along with a catheter positioned in the ascending aorta, and a strain gauge the left ventricle. Isoproternol (4 micrograms), Arfonad Arfonad (2 mg), and propanolol (1.5 mg/kg.) were given IV with an appropriate time interval drug. The dP/dt sub max correlated with the height of the max correlated with the height of the strain gauge recording. The impedance output, either dP/dt sub max or the height of dP/dt sub max or the height of the strain gauge recording. Author

N70-10015*# Orange County Medical Center, Calif.
A COMPARISON OF CARDIAC OUTPUT VALUES BY THE IMPEDANCE CARDIOGRAPH AND DYE DILUTION TECHNIQUES IN CARDIAC PATIENTS
Loren W. Heather *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 247–258 (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

Data obtained by use of the impedance cardiograph with simultaneous data obtained at cardiac catherization and angiocardiography are correlated. The conclusions reached after studying 38 patients are: (1) Aortic insufficiency results in increased impedance output, in proportion to the severity of the insufficiency. (2) Mitral insufficiency, in moderate or severe degree, gives a falsely low impedance output by the impedance technique. (3) In other individuals impedance output seems to be relatively similar to dye dilution output. (4) An index is proposed for evaluation of left ventricular function. F.O.S.

N70-10016*# Marquette Univ., Milwaukee, Wis.
ESTIMATE OF CARDIAC OUTPUT WITH THE IMPEDANCE CARDIOGRAPH DURING POSTURAL STRESS
James J. Smith, John E. Bush, V. Thomas Wiedmeier, and Felix E. Tristani *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 259–266 refs (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

A number of cardiac output determinations by densitometer measurements and stroke volume estimation during head-up tilt of

humans were analyzed: (1) to assess the validity of the transthoriacic impedance method for the measurement of cardiac output; and (2) to determine its possible usefulness in studying circulatory response to postural and other tests. In 35 simultaneous determinations a correlation coefficient of +0.87 was found between the two methods; impedance readings averaged about 10% higher than densitometer dye readings. Impedance records were also analyzed for auxiliary hemodynamic values, such as dZ/dt, the (R-Z) interval, and left ventricular ejection time. It was concluded that impedance cardiography may have considerable potential for application in cardiology. G.G.

N70-10017*# Air Force Academy, Colo. Bioengineering Lab.
A COMPARISON OF CHANGES IN STROKE VOLUME AND CARDIAC OUTPUT IN SUBJECTS STRESSED BY UPRIGHT TILT AND LOWER BODY NEGATIVE PRESSURE
Richard J. Gowen, Richard D. Barnett, and Fred L. Zaebst *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 287-295 refs (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

The impedance cardiograph was used to measure stroke volume, heart rate and cardiac output changes in six normal subjects during tests designed to compare the cardiovascular effects of -20, -30, -40 and -50 mm Hg lower body negative pressure with those produced by 70° upright tilt. Repeatable stroke volume results were obtained from all subjects during recumbent rest and stress. For the three parameters measured, tilt was found to represent a greater stress than -20, -30 or -40 mm Hg pressure. -50 mm Hg or a combined -40, -50 mm Hg profile was found to represent a greater stress than tilt. It was concluded, therefore, that the equivalency point for negative pressure versus tilt lies somewhere between -40 and -50 mm Hg pressure. When a tilt stress was preceded during the same experiment by a negative pressure stress, the responses were greater than those obtained when tilt was the initial stress. Author

N70-10018*# Baylor Univ., Houston, Tex. Dept. of Physiology.
COMPARATIVE EVALUATION OF THE THORACIC IMPEDANCE AND ISOTOPE DILUTION METHODS FOR MEASURING CARDIAC OUTPUT
W. V. Judy, F. M. Langley, K. D. Mc Cowen, D. M. Stinnetti, L. E. Baker et al *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 296-300 refs (See N70-10001 01-04)
(Grant HE-5125)
Avail: CFSTI CSCL 06E

Values of cardiac output determined simultaneously in 17 normal adult male human subjects by means of thoracic impedance changes and radioisotope dilution are compared. The absolute values of cardiac output determined by the impedance technique were 1.31 times higher than those measured by radioisotope with the subjects at rest and after moderate exercise. Even though the absolute values as found by the two methods were not the same, the changes in magnitude were comparable. Author

N70-10019*# Baylor Univ., Houston, Tex.
COMPARATIVE EVALUATION OF THE THORACIC IMPEDANCE AND ELECTROMAGNETIC FLOW PROBE METHOD FOR MEASURING CARDIAC OUTPUT
William V. Judy, Frank M. Langley, Karl D. Mc Cowen, and Lee E Baker *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 301-313 refs (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

It has been found that the transthoracic electrical impedance method's ability to estimate cardiac output compares very well with that of the electromagnetic flowmeter in dogs. A correction value of 1.05 was found between the two techniques as compared to 1.18, 1.29, and 1.31 previously found in dilution method comparisons. The absolute values determined in this study correlated well ($r = 0.92$) and a mean difference of 5 percent was found. It is felt that the characteristics of the ease of application, lack of invasive procedures or implants inherent to the ACG method along with the knowledge gain in this study is sufficient to warrant continued use of this method. Author

N70-10020*# Public Health Service Hospital, Baltimore, Md. Clinical Investigations Service.
EVALUATION OF ELECTRICAL IMPEDANCE CARDIOGRAPHIC MEASUREMENTS OF HEART FUNCTION IN COMPARISON TO INDICATOR DILUTION AND PRESSURE GRADIENT METHODS
Ray T. Steigbigel, Henry Babbit, and J. Richard Warbasse *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 314-329 refs (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

Cardiac output, stroke volume, and peak ascending aortic blood velocity estimates obtained from impedance, indicator flow, and pressure gradient measurements were compared and evaluated. Measurements were made during ventricular premature contractions, the Valsalva maneuver, normally conducted beats, isoproterenol infusion, and during rest and recovery periods. Preliminary correlation data suggest that the impedance cardiogram is useful in instantaneous evaluation of mechanical heart functions. G.G.

N70-10021*# Minnesota Univ., Minneapolis. Dept. of Physical Medicine and Rehabilitation.
EVALUATION OF IMPEDANCE CARDIOGRAPHIC TECHNIQUES FOR MEASURING RELATIVE CHANGES IN CARDIAC OUTPUT BY SIMULTANEOUS COMPARISON WITH INDICATOR DILUTION AND ELECTROMAGNETIC FLOWMETER
David A. Witsoe, Robert P. Patterson, A. H. L. From, and W. G. Kubicek *In its* Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 330-355 (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

Results are presented of an evaluation of impedance techniques for monitoring relative changes in cardiac output. The cardiovascular system of the anesthetized dog was stressed, and cardiac output was monitored using three techniques: the indicator dilution method, electromagnetic flowmeter, and impedance cardiography. To achieve the desired results, several drugs were used to vary four cardiovascular function parameters: heart contractility, peripheral resistance, pulse rate, and stroke volume. The experiments involved cardiovascular stress over a wide dynamic range to 14 dogs; in some cases the stress was nearly to the point of destruction. The ability of the impedance system to predict relative changes in cardiac output was not as satisfactory as that achieved with dye dilution and flowmeter methods. There were sufficient conditions, however, under which the method did accurately predict the changes to warrant further efforts and research. A.C.R.

N70-10022*# Washington Univ., Seattle. Dept. of Anesthesiology.
IMPEDANCE STROKE VOLUME: A COMPARISON IN DOGS AND MAN WITH ELECTROMAGNETIC FLOWMETERS AND DYE DILUTION RESPECTIVELY
Wayne E. Martin *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and

Other Cardiac Parameters 30 Jun. 1969 p 357-384 (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

Observations of stroke volumes in dogs were extended over a wide variety of cardiovascular states, including altered contractility, peripheral vasoconstriction and vasodilation, and hypovolemia. In addition, measurements were obtained using human subjects whose cardiovascular systems were depressed. The data indicate that the impedance cardiogram, in its present configuration, is not a suitable clinical tool, because the possibility exists that the data obtained at a critical instant might show good cardiac function when the system is actually in a state of collapse or vice versa. The overall correlation between conventional and impedance stroke volume, however, indicates that the method may be useful in special circumstances. In particular, it could be utilized in space medicine if proper weight is given to the above limitations. A.C.R.

N70-10023*# Rochester Univ., N.Y. Coll. of Engineering and Applied Science.
CARDIAC OUTPUT FROM TRANSTHORACIC IMPEDANCE VARIATIONS, REVIEW OF EXPERIENCE WITH HEART PATIENTS
E. Kinnen *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 385-403 refs Sponsored by USAF/ONR/NSF (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

Results of a study of the changes in electrical impedance fluctuations measured across the thorax are reported in an attempt to ascertain whether these changes can be used as the basis of an indirect measure of cardiac output (CO) or stroke volume. Specifically, efforts in interpreting impedance waveforms and their effects on the accurate prediction of CO in man are reviewed. A brief description of the plethysmograph for recording the impedance variations and the procedure used to obtain the data is also given. A.C.R.

N70-10024*# Miami Univ., Fla. Dept. of Neurology.
RESISTIVE AND REACTIVE (CAPACITIVE) CARDIAC IMPEDANCE PULSES
Richard Namon and Frank Gollan *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and Other Cardiac Parameters 30 Jun. 1969 p 404-421 refs (See N70-10001 01-04)
(Grants NB05654-01; HE-09868)
Avail: CFSTI CSCL 06E

An indirect method to measure cardiac stroke volume, using electrical impedance methods with electrodes on the body surface of anesthetized greyhound dogs, was developed. The amplitude of resistive and reactive impedance pulses was compared with the stroke volume calculated from cardiac output determinations using the green dye dilution technique. Reactive impedance pulses reflected the stroke volume changes more accurately and were therefore used for the study. In 14 dogs, reactive impedance changes were compared with 129 dye dilution determinations over a wide range of stroke volumes produced by hemorrhage, transfusion, hypothermia, and drugs. The correlation coefficient between the two methods was 0.91. The standard deviation from a best-fit line on a log-log plot amounted to 19% and 0.53 milliohm ocrresponded to 1 milliliter of stroke volume. Author

N70-10025*# Scott and White Clinic, Temple, Tex.
THE POTENTIAL ROLE OF IMPEDANCE PLETHYSMOGRAPHY IN AEROSPACE MEDICINE
Robert D. Allison *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac output and Other Cardiac Parameters 30 Jun. 1969 p 422-468 refs (See N70-10001 01-04)
Avail: CFSTI CSCL 06E

The suitability of biological impedance measuring techniques for studies in earth-based laboratories and for evaluating biological parameters in the dynamic environment related to human activity on earth and in space is discussed. The applications of four-electrode impedance plethysmography are treated in the following areas: (1) cardio-pulmonary dynamics of ventilation, stroke volume, and cardiac output; (2) blood volume distributions during weightlessness and changes in body posture; (3) measurements of peripheral pulse volume and blood flow, with particular reference to environmental factors influencing these measurements; (4) effects of age and blood pressure changes on recorded peripheral blood pulse volumes; and (5) measurements of kidney-area blood pulse volume; in addition, the concept of silhouette studies using impedance plethysmography in the unconditioned healthy subject and the subject exposed to environmental and pathological stress is also taken into account. Author

N70-10046*# Texas Inst. for Rehabilitation and Research, Houston.
EVALUATION OF PHONOCARDIOGRAPHIC DATA OF ASTRONAUTS DURING ORBITAL FLIGHTS
Carlos Vallbona (Baylor Univ., Houston, Tex.), Lawrence F. Dietlein (NASA, Manned Spacecraft Center, Houston, Tex.), and William V. Judy (NASA, Manned Spacecraft Center, Houston, Tex.) [1969] 35 p refs
(Contract NAS9-6162)
(NASA-CR-101981) Avail: CFSTI CSCL 06S

Simultaneous electrocardiographic and phonocardiographic records were obtained from both crew members during the flights of Gemini 4 and 5 and on the pilot of Gemini 7. Analysis of the data recorded during flight reveals: wide fluctuations of the duration of the cardiac cycle within physiological limits throughout the mission; fluctuations in the duration of the electromechanical systole that correlated with the changes in heart rate; stable values of the electromechanical delay; considerable shortening of the duration of the cardiac cycle (i.e. increase in heart rate), of the electromechanical systole and, to a lesser extent, of the electromechanical delay at lift-off, at reentry and for the few hours that preceded reentry. It is likely that the shortening of the cardiac cycle and of its phases occurred in response to positive chronotropic and inotropic influences (adrenergic reaction) that were observed in all the astronauts who participated in this experiment. Author

N70-10100*# Techtran Corp., Glen Burnie, Md.
BIOLOGICAL EFFECT OF LOW MAGNETIC FIELD ENVIRONMENTS [ACTION BIOLOGIQUE DES AMBIANCES A FAIBLE CHAMP MAGNETIQUE]
L. Miro Washington NASA Nov. 1969 6 p refs Transl. into ENGLISH from the French
(Contract NASw-1695)
(NASA-TT-F-12691) Avail: CFSTI CSCL 06F

Irridiation by cosmic rays in the absence of the protective geomagnetic field, and the direct action of the low magnetic field could cause adverse effects. Tests are cited (physiological, visual, and psychological) which indicate no differences between experimental and control subjects, whether animal, plant, or human. Only the critical threshold of fusion was significantly disturbed. In prolonged experiments on mice, however, after four months alopecia due to generalized hyperplasia was observed, with premature death of the animals in four months to one year. Consideration of these results leads to the conclusion that additional long term experiments are needed. Author

N70-10124 National Lending Library for Science and Technology, Boston Spa (England).
INFORMATION CODING IN THE PERIPHERAL PART OF THE AUDITORY SYSTEM [O KODIROVANII INFORMATSII V PERIFERICHESKOM OTDELE SLUKHOVOY SISTEMY]
I. A. Lyubinskiy Jul. 1969 23 p refs Transl. into ENGLISH

from Teor. i Sredstva Automatiki (USSR), 1968
(NLL-RTS-5240) Avail: Natl. Lending Library, Boston Spa, Engl.: 25s

Improvement in sharpening for the conversion of information provided by a sound signal was investigated in the receptor cells and in the neurons of the spiral ganglion. Vibratory processes in the basilar membrane and the neuronal elements of the cochlea were examined. Increasing the tuning sharpness of neurons in the spiral ganglion by summating the responses of many hair cells within the spiral fiber was selected as a possible mechanism; this hypothesis did not introduce lateral connections between neurons of the spiral ganglion. The conclusions indicate that: (1) although the basilar membrane has a low figure of merit, this property apparently increases the response speed of the auditory system; (2) neurons at the first stage of the auditory system have higher selectivity than the basilar membrane; (3) the velocity of wave propagation travelling in the membrane is a constant at the place of maximum amplitude of membrane vibration, (4) a model of neural improvement in sharpening using the disperse properties of the membrane and the ability of a spiral fiber to summate responses of many receptor cells is feasible. M.H.E.

N70-10136# Federation of American Societies for Experimental Biology, Bethesda, Md.
EFFECT OF OXYGEN TENSION IN THE SURROUNDING MEDIUM ON CORTICAL ELECTRICAL ACTIVITY DURING HYPOTHERMIA
Yu. S. Alyukhin 1969 18 p refs Transl. into ENGLISH from Fiziol. Zhurnal SSSR (Moscow) v. 54, no. 9, 1968 p 998–1012
(PB-184206T; NS-148) Avail: CFSTI CSCL 06P

A decrease in pressure of the inspired air to 360 and 220 mm Hg causes a relative decrease in the integral area (at brain temperatures of 30-22C) and frequency (at brain temperatures of 32-18C) of cortical potentials of rats during hypothermia. During progressive cooling of rats the temperature at which cortical electrical activity ceases is almost or completely independent of the oxygen tension in the surrounding medium. Hypoxia probably does not play an important role in the hypothermic depression of cortical electrical activity in rats. Author (USGRDR)

N70-10137# Federation of American Societies for Experimental Biology, Bethesda, Md.
SHAPE OF THE ELECTRIC FIELD CREATED BY A BIPOLAR NEURON
N. F. Podvigin 1969 17 p refs Transl. into ENGLISH from Biofizika (USSR) v. 13, no. 2, 1968 p 282–289
(PB-184200T; NS-123) Avail: CFSTI CSCL 06P

The paper gives details of the configuration of the electric field generated by a multidendritic neuron, a bipolar cell of the retina. The field potential was determined by means of an analog model, an electrolytic bath, from its internal layers. Author (USGRDR)

N70-10138# National Library of Medicine, Bethesda, Md.
AN ANNOTATED BIBLIOGRAPHY OF BIOMEDICAL COMPUTER APPLICATIONS
Ruth Allen, comp. Jun. 1969 221 p
(Contract PH-43-67-1152)
(PB-184225) Avail: CFSTI CSCL 06E

The document is an annotated bibliography of publications on the application of computer science to biomedicine. It presents bibliographies, books and monographs, and selected articles representative of the many aspects of biomedical computing. The aim of the bibliography is to make articles of particular interest to the reader more accessible by pointing out the various method and techniques and their applications in the various biomedical fields, and by indicating what material is discussed in each article. USGRDR

N70-10169*# Dynamic Science Corp., Monrovia, Calif.
MICROBIAL CELL RECOVERY FROM SOLID MATERIALS Final Summary Report
14 May 1968 282 p refs Prepared for JPL
(Contracts NAS7-100; JPL-950740)
(NASA-CR-106488) Avail: CFSTI CSCL 06M

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N70-10170*# Dynamic Science Corp., Monrovia, Calif.
MICROBIAL CELL RECOVERY FROM SOLID MATERIALS, VOLUME 1
In its Microbial Cell Recovery from Solid Mater. 14 May 1968 p 3–52 refs Prepared for JPL (See N70-10169 01-04)
Avail: CFSTI CSCL 06M

Methods of preparing spacecraft solid materials for microbial recovery and techniques of culturing microorganisms are discussed. Pulverization by hacksaws is investigated, and fine tooth blades made of nickel molybdenum alloy or tungsten steel are recommended. Polyester and epoxy resins were pulverized satisfactorily and solid rocket propellant was the most difficult component material. Fluids for leaching pulverized materials and for neutralizing toxic materials are described, and the most effective for several plastics are indicated. Procedures for culturing microorganisms are outlined, and include chamber assembly, surface decontamination, ethylene oxide analysis and replacemant with air, as well as the pulverizing and leaching methods. N.E.N.

N70-10171*# Dynamic Science Corp., Monrovia, Calif.
MICROORGANISMS IN SOLID MATERIALS, VOLUME 2, PHASES 1–4
In its Microbial Cell Recovery from Solid Mater. 14 May 1969 p 53–186 refs Prepared for JPL (See N70-10169 01-04)
Avail: CFSTI CSCL 06M

Research on the detection and recovery of microorganisms in solid spacecraft materials is reported. Culturing was found to be the most reliable method of detecting viability, but electron spin resonance, fluorescent and nonfluorescent staining, electrophoreses and autoradiography were investigated as potentially useful methods. Pulverization of the solids prior to culturing was done by drilling, ball mill, blender, and mortar and pestle. Drilling was the most effective, but recoveries of *B. subtilis* var. *niger*, *Clostridium sporogenes*, and *Ulocladium* were considered to be low. The reliability of drilling and culturing techniques was investigated utilizing cultural determinations at 37° and 25°C. The recoveries were highest when the inoculum was distributed uniformly throughout the solid. Factors affecting the recovery are discussed, and improvements in assaying techniques are described. N.E.N.

N70-10172*# Dynamic Science Corp., Monrovia, Calif.
MICROORGANISMS IN SOLID MATERIALS, VOLUME 3, TASK 1: RESISTANCE OF ALPHA ORGANISMS TO DRYING

AND TO STERILIZATION BY ETHYLENE OXIDE

In its Microbial Cell Recovery from Solid Mater. 14 May 1969 p 187-223 refs Prepared for JPL (See N70-10169 01-04)
Avail: CFSTI CSCL 06M

The results of experiments to determine the ethylene oxide resistance of populations of alpha in a variety of environments and after several types of pretreatment are presented. The evidence for identifying *alpha* as a strain of *Staphylococcus epidermidis* is given, and its habitat and clonal variation are mentioned. Data on the resistance of *alpha* populations to several environmental factors are tabulated. The dominant factor in destroying viability of *alpha* populations was determined to be drying process in the absence of protective agents. The sensitivity of toxic propellant ingredients was found to depend on the state of the organisms when placed in contact with the ingredient. Native contamination in propellant ingredients was observed to be low. N.E.N.

N70-10173*# Dynamic Science Corp., Monrovia, Calif.
MICROORGANISMS IN SOLID MATERIALS, VOLUME 4, TASK 2: NATURALLY OCCURRING MICROBIOLOGICAL FLORA FROM NORMALLY PREPARED PROPELLANT SPECIMENS

In its Microbial Cell Recovery from Solid Mater. 14 May 1968 p 224-255 refs Prepared for JPL (See N70-10169 01-04)
Avail: CFSTI CSCL 06M

The extent and character of microbiological contamination in each of two batches of solid propellant were measured. In a portion of one batch a population as large as 10^6 cells/milliliter was found. While no thermophiles nor obligate anaerobes were detected, many species of aerobes and facultative anaerobes were. Several of these species appear to be more resistant to ethylene oxide than are spores of *B. subtilis*, var. *niger*. Author

N70-10174*# Dynamic Science Corp., Monrovia, Calif.
MICROORGANISMS IN SOLID MATERIALS, VOLUME 5, TASK 3: RECOVERY LEVELS OF MICROBIAL ORGANISMS INOCULATED INTO SOLID PROPELLANT SPECIMENS

In its Microbial Cell Recovery from Solid Mater. 14 May 1969 p 256-286 Prepared for JPL (See N70-10169 01-04)
Avail: CFSTI CSCL 06M

The minimum number of microorganisms that can be inoculated in solid propellants and subsequently detected by cultural techniques was investigated. The organisms were *Bacillus subtilis* var. *niger*, *Clostridium sporogenes*, *Serratia marcescens*, *Ulocladium*, and *Staphylococcus epidermidis*. Pulverizing the propellant by sawing and leaching are described. Organisms were recovered in all cases at 100/cu cm of inoculum and at the 10/cu cm *B. subtilis*, *C1. sporogenes*, and *Staph. epidermidis*. Contaminating organisms as well as test organisms were found in the propellants and in the leached supernatant fluid. The results are considered to indicate that the recovery techniques can be refined to obtain an efficiency of less than one microorganism per cubic centimeter. *N.E.N.*

N70-10280# Leiden Univ. (Netherlands). Dept. of Radiation Genetics.
MOLECULAR AND RADIATION GENETICS Final Report
Brussels EURATOM 1969 90 p refs
(Contract EURATOM-052-65-1 BIAN)
(EUR-4249-e) Avail: CFSTI

Research activities of the Laboratories for Physiological Chemistry and Applied Enzymology and Radiobiology were distributed over six subjects: (1) *in vitro* induction of protein synthesis in general, the synthesis of immune antibodies in particular and the effect of radiation thereon; (2) relation between structure and function of the DNA of viruses including bacterial and animal viruses and the modifying effects of radiation upon them; (3) genetics of micro-organisms and the effect of radiation (UV and ionizing radiation) on such functions as viability, cell division and mutation of bacteria; (4) the effect of ionizing radiation on DNA; (5) mechanism of action of enzymes and modification by irradiation; and (6) investigations of mutations that modify the biological activity of enzymes. Research activities of the Department of Radiation Genetics were divided between the following three subjects: (1) mutation studies with Drosophila; (2) gene function, genetic recombination and replication of DNA of bacteriophage and the effect radiation on these processes; (3) studies in regulatory mechanisms of somatic cells *in vitro*. Author

N70-10345# Bureau of Radiological Health, Rockville, Md.
BIOLOGICAL ASPECTS OF LASER RADIATION. A REVIEW OF HAZARDS
Wellington Moore, Jr. Jan. 1969 18 p refs
(PB-184003) Avail: CFSTI CSCL 06E

Concern over the hazards of exposure to laser radiation has resulted in the establishment of guidelines for human exposure by several agencies. Owing to the incompleteness of knowledge concerning biological effects, particularly long-term ones, it is not possible to set firm protection standards at this time. Current guides are based upon the minimum dose required to produce a visible lesion. These threshold values may vary depending upon the criteria by which they are measured. For the eye, threshold damage has been determined by such varying means as ophthalmoscopy, light microscopic histology, histochemical study, and electroretinography. Author (USGRDR)

N70-10384# Library of Congress, Washington, D.C. Aerospace Technology Div.
REPORT ON INTERNATIONAL PROGRESS IN CEREBRAL ELECTROTHERAPY (ELECTROSLEEP) AND ELECTROANESTHESIA
Arsen Iwanovsky *In its* Foreign Sci. Bull., vol. 5, no. 10 Oct. 1969 p 15-40 refs (See N70-10382 01-34)
Avail: Issuing Activity

Papers presented at the symposium in September 1969 are reviewed. Emphasis in the presentations was placed on basic research and quantitative evaluation of clinical results. New equipment was displayed and is described briefly. N.E.N.

N70-10518 Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
MOESSBAUER EFFECT ON FERRO-PORPHYRIN SYSTEMS [MOESSBAUEREFFEKT AN FERRO-PORPHYRIN-SYSTEMEN]
Alfred Trautwein (Ph.D. Thesis) 1969 10 p refs In GERMAN
Avail: CFSTI

Erroneous interpretations or the complete lack of them for the quadrupole splitting Delta E sub Q and the isomeric shifts delta of Fe(2+) porphyrin systems prompted these calculations and experiments. It was found that the mutual Coulomb rejection of the Fe 3d electrons must not be neglected. Temperature dependence magnitude of Delta E sub Q and delta for deoxidized hemoglobins Hb and dipyridine hemins could be explained only when considering spin-orbit coupling of the low energy terms. Plus/minus sign and order of magnitude of the calculated electric HbO2 agreed with the experiment under the condition that the spin triplets of the valence electrons of free O2 and of Fe in the Hb are combined in one spin singlet ground state in the HbO2. The Delta E sub Q (T) was predicted for the first time for ferro-porphyrin systems with a spin triplet ground state. In the Moessbauer experiments with the anhydrohemoglobin it was possible to determine the low-energy term 3d(6) configuration and to use the resulting electron term energies in susceptibility calculations that were also experimentally verified. During the preparation of the haptoglobin-hemoglobin absorber it was possible for the first time to crystallize a protein-protein complex. Transl. by K.W.

N70-10601*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

SIGNIFICANCE OF ANISOTROPHY AND HOMOGENEITY FOR THE DETERMINATION OF THE ELASTICITY OF BLOOD VESSELS

Victor Hardung Washington, D.C. NASA Oct. 1969 17 p refs Transl. into ENGLISH from Angiologica, v. 1, no. 2, 1964 p 141 - 155 Sponsored by Swiss Natl. Fund for Sci. Res.
(Contract NASw-1692)
(NASA-TT-F-12608) Avail: CFSTI CSCL 06P

Formulas are derived for the deformation of cylindrical or prismatic bodies in different directions in space, as well as for the deformations of a tube exposed to internal excess pressure. Discussion of the results gives some indications for avoiding erroneous conclusions in the interpretation of elasticity measurements on muscle fibers and blood vessels. Author

N70-10686# Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N.Mex.

THE ADVANTAGES OF REARWARD-FACING SEATS DURING POST DECOMPRESSION EMERGENCY DESCENT OF MULTI MACH/HIGH ALTITUDE TRANSPORT AIRCRAFT Technical Report, Nov. 1968 - Mar. 1969

Harold J. Von Beckh Jul. 1969 20 p refs
(AD-692508; ARL-TR-69-15) Avail: CFSTI CSCL 6/5

During the post decompression emergency descent of Multi Mach/High Altitude Aircraft the occupants will be subjected to deceleration induced inertial loads in the direction of the flight path which will temporarily reach or exceed values of 0.5 G. Forward-facing passengers who have not been able to don the oxygen mask may lose consciousness for various periods of time and will assume positions which are unfavorable for the recovery from hypoxic stress. Aft-facing passengers - even if unconscious - would not lose contact with their seat and seatback and would assume a semisupine position by the combined effect of the aircrafts negative attitude angle and the decelerative load. Recent research suggests that the semisupine position is favorable for recovery from severe hypoxic exposures. A reassessment of the value of aft-facing versus forward-facing passenger seats for subject aircraft is suggested. Author (TAB)

N70-10692 National Lending Library for Science and Technology, Boston Spa (England).

THE VITAMÍN C REQUIREMENTS OF THE CREWS OF SEAGOING VESSELS [S-VITAMINAYA OBESPECHENNOST EKIPAZHEI SUDOV DALNEISHEGO PLAVANIYA]

E. P. Boiko Jul. 1969 14 p refs Transl. into ENGLISH from Vopr. Pitaniya (Moscow), v. 27, no. 3, 1968 p 46 - 52
(NLL-RTS-5232) Avail: Natl. Lending Library, Boston Spa, Engl. 17s 6d

Male crew members were investigated for dietary vitamin C intake from food products; urinary ascorbic acid excretion; signs of C hypovitaminosis; and response to vitamin supplementation over a two year period. Subjects fed on naval rations obtained from supply bases replenished in foreign ports included engineers and deck hands, daytime and night time workers, under at anchor and at sea conditions. It was concluded: (1) Vitamin C requirements of long distance ship crews depended on provisioning the ships for an adequate diet, the meteorological conditions of the area, and the amount of physical strain. (2) The tropical climate created the greatest need for vitamin C requirements which increased in the engineering crew during the voyage and in the upper deck hands at anchorage. (3) Rapid passage from one climatic zone to another possibly caused a decline in the body's vitamin C reserves. (4) The optimum dose of vitamin C per man in 24 hours is 150 to 175 mgm to be supplemented by dietary doses of 50 to 75 mgm, particularly during the winter/spring period. However, during voyages in the tropics, the optimum dose is 175 to 250 mgm per man in 24 hours, to be supplemented with dietary doses of 75 to 150 mgm. M.H.E.

N70-10790# Kollsman Instrument Corp., Syosset, N.Y. Corporate Technology Center.

TRANSMISSION OF ENERGY THROUGH INTACT SKIN BY ULTRASONIC POWER Annual Summary Report, 27 Jun. 1967 - 28 Jun. 1968

J. Kritz and W. M. Nelson 1969 99 p refs
(Contract PH-43-67-1415)
(PB-185482; ASR-1) Avail: CFSTI CSCL 06L

The report was directed at studying a means of transmitting power through the intact human skin at a level of thirty watts of available power. The technique investigated utilizes the energy transmission via ultrasonic radiation with conversion to useful electrical power while minimizing energy dissipation in the skin interface. Author (USGRDR)

N70-10801*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.

AN ANALYSIS OF CARBON 14 RADIATION DETECTION SYSTEMS

K. Wainio Oct. 1969 92 p refs
(Contract NAS2-5546)
(NASA-CR-73384; BSR-2781) Avail: CFSTI CSCL 06A

Systems for detecting Martian life are described and evaluated. The experiments are designed to investigate soil containing microorganisms and exposed to C-14 labelled organic nutrients, carbon-14 dioxide dark release from soil incubated in labelled carbon dioxide atmosphere simulating Martian daylight, and pyrolysis products from C-14 labelled organic compounds in soils. One principal detector consists of a pair of small detectors mounted face-to-face with the C-14 gas introduced between them. Several designs are described and the study indicates that the semiconductor detectors generally are more satisfactory than the thin window pancake detectors. The other principal detector is a thin plastic scintillation detector wrapped in another scintillator to permit coincidence rejection of background radiations, and preliminary experiments are considered encouraging. Other detection techniques are considered, along with the shielding for the background radiation which is expected to be mainly gamma rays from the radioisotope thermoelectric generator. N.E.N.

N70-10863# Continental Can Co., Inc., Chicago, Ill. Metal Div. Research and Development.

GROWTH CHARACTERISTICS OF TYPE E CLOSTRIDIUM BOTULINUM IN THE TEMPERATURE RANGE 34 TO 50 DEG F Progress Report

W. P. Segner and C. F. Schmidt Oct. 1968 6 p refs
(Contract AT(11-1)-1183)
(COO-1183-28) Avail: CFSTI

The growth characteristics of *Clostridium botulinum* Type E on irradiated (0.1 and 0.2 Mrad) samples of fresh haddock maintained at refrigerated storage temperatures (34 to 50°F) were studied. Samples were inoculated with various numbers of spores and assays for toxin were conducted at various times during the next 40 days. NSA

N70-10866*# McDonnell-Douglas Co., St. Louis, Mo. Human Performace Lab.

IMAGE MOTION STABILIZATION REQUIREMENTS FOR DYNAMIC VISUAL TASKS IN SPACE

Barry J. Cohen, James T. Miller, and A. John Eschenbrenner 15 Jan. 1969 166 p refs
(Contract NAS2-4985)
(NASA-CR-73351; G-864) Avail: CFSTI CSCL 06P

An analytical study was performed to determine the requirements for stabilizing images of visual targets to be detected and observed by astronauts in future NASA space missions. An Earth resources survey mission, a Moon landing mission, and a Mars landing mission were used to define physical characteristics that

would influence the performance of visual tasks. Expected image velocities of targets in each task were compared with the image velocities defining smear thresholds for human vision, photographic films, and electronic sensors to determine image motion stabilization (IMS) requirements. These requirements were used to develop the functional requirements for an IMS system and a plan for its laboratory and airborne testing. Author

N70-10874*# Matrix Corp., Alexandria, Va.
AN ANALYSIS OF ASTRONAUT PERFORMANCE CAPABILITY IN THE LUNAR ENVIRONMENT. VOLUME 2: PERFORMANCE CAPABILITY SUPPORT DATA
Thomas B. Malone, Henry E. Bender, and Morton H. Kahn 6 Aug. 1969 315 p refs
(Contract NASw-1751)
(NASA-CR-106663) Avail: CFSTI CSCL 06S

A research project directed toward the objectives of defining astronaut performance capabilities in the lunar environment, and supporting the man-machine interface design, operational procedures, decision rules, and training requirements associated with these items is presented. The study is in these general areas: lunar environment, mission, equipment, operations, and research findings concerning astronaut performance and safety. A description of experiments for astronaut performance on the lunar surface, during early Apollo missions is included. F.O.S.

N70-10889*# University of Southern Calif., Los Angeles. School of Medicine.
BLOOD PRESSURE, SENSOR DEVELOPMENT, ATRIAL SIZE MEASUREMENT, AND IMPLANT MATERIALS Progress Report, 10 Apr. – 9 Jul. 1969
John P. Meehan 14 Aug. 1969 24 p
(Contract NSR-05-018-087)
(NASA-CR-106556) Avail: CFSTI CSCL 06P

During this reporting period the major efforts were concentrated in: (1) completing the development of the blood pressure measuring system, (2) developing a differential venous pressure transducer, (3) investigating implant materials and shapes, and (4) evaluation of atrial size measurement as a redundant measurement for central venous pressures. Author

N70-10895 National Lending Library for Science and Technology, Boston Spa (England).
LIFE IN A MAGNETIC FIELD [ZHIZN V MAGNITNOM POLE]
M. P. Travkin Jul. 1969 16 p Transl. into ENGLISH from Khim. i Zhizn (USSR), v. 9, 1968 p 22 – 25
(NLL-RTS-5237) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s

The history of magnetobiological research is reviewed and observed effects of magnetic fields on living matter are briefly outlined. Emphasis is placed on the effects of terrestrial magnetism on protoplasm movement in leaf cells, the effects of increased solar activity with intensified electromagnetic fields on epidermic eruptions on humans, and low magnetic field induced disorientations in birds and grain growth directions. Prolonged action of a magnetic field in simulated space conditions caused changes in blood composition of animals and produced conditioned reflexes in fish. The theory is projected that cross-linking of the biological water molecules under the influence of a magnetic field is the basis of its biological action through changing the orientation of the nuclear spin of hydrogen in the water molecule. Also described is a theory that attributes biological effects of a magnetic field to informational reaction of the external electromagnetic field with the living systems by means of the field generated by the organism itself. G.G.

N70-10908# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL INVESTIGATIONS OF HYPOKINESIA, ALTERED ATMOSPHERES, ACCELERATION, EXCESS g-FORCES AND OTHER FACTORS [EKSPERIMENTALNYE ISSLEDOVANIYA GIPOKINEZII, IZMENENNOI GAZOVOI SREDY, USKORENII, PEREGRUZOK I DRUGIKH FAKTOROV]
6 Jun. 1969 130 p refs Transl. into ENGLISH from collection of Russian Articles
(AD-692624; FTD-HT-23-1311-68) Avail: CFSTI CSCL 6/19

The material is divided into major topics which include: Hypokinesia, Altered Atmospheres, Acceleration and Excess g-Forces, Radiation, Hypothermia, Tissue Cultures, General Problems of Morphology and Physiology, and finally, a Miscellaneous entry. Each of these categories contains a number of pertinent research articles and studies. Author (TAB)

N70-10909# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIOTOXINS: THEIR NATURE AND ROLE IN THE BIOLOGICAL EFFECT OF HIGH-ENERGY RADIATION
A. M. Kuzin, ed. 17 Dec. 1968 378 p refs Transl. into ENGLISH of the book "Radiotoksiny, Ikh Priroda i Rol' v Biologicheskom Deystvii Radiatsii Vysokoy Energii" 2 Moscow, Atomiz Dat, 1968 p 1 – 293
(AD-691870; FTD-HT-23-492-68) Avail: CFSTI CSCL 6/18

Theoretical and experimental data are presented on the formation of toxins in irradiated organisms. For individual titles, see N70-10908 through N70-10950.

N70-10909# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIOTOXINS: THEIR POSSIBLE NATURE AND ROLE IN THE DEVELOPMENT OF RADIATION LESION
A. M. Kuzin (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 4 – 17 refs (See N70-10908 01-04)
Avail: CFSTI

The effects of radiation on cells and tissues and theories of genetic changes due to radiation are discussed. The dependence of radiotoxin concentration is shown to decrease with increased distance the radiotoxin travels through the medium. The genetic theory that requires a direct hit for radiation to cause a mutation is described and refuted. The theory of hitting multiple structures with radiotoxin formation is also described, and it is pointed out that the radiotoxin concentration increases with time after radiation. The formation of quinones from irradiation and their reactions with enzymes are described. The absence of oxygen at the time of irradiation was found to retard quinone production. Experimental facts which support the role of radiotoxins in the mutagenic effect are presented. N.E.N.

N70-10910# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANISM OF FORMATION AND IDENTIFICATION OF TOXIC SUBSTANCES OF QUINOID NATURE FORMING IN AN IRRADIATED ORGANISM
V. A. Kopylov (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 18 – 27 refs (See N70-10908 01-04)
Avail: CFSTI

Experiments investigating the nature of the formation of toxic substances are reviewed. The greater concentration of toxins in irradiated organic matter than in nonirradiated media is emphasized. Some of the toxins are identified, and the importance of quinones as one of the primary toxic groups is indicated. The reactivity of quinones, their postirradiation concentration increase, and the effects of enzymes on the oxidation of phenols to quinones are discussed. N.E.N.

N70-10911# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

QUANTITATIVE PRINCIPLES OF THE APPEARANCE OF QUINONES IN IRRADIATED PLANT TISSUES AND YEAST CELLS

N. Norbayev (Acad. of Sci., USSR) and A. M. Kuzin (Acad. of Sci., USSR) *In its* Radiotoxins 17 Dec. 1968 p 28-36 refs (See N70-10908 01-04)

Avail: CFSTI

The increase in formation and excretion of quinones in irradiated corn germinants and diploid wine yeasts were studied. The quinone content in the germinants was found to increase with the dosage and postirradiation time. The excretion of quinones was smaller in irradiated germinants than in the controls when the dosage was below 5 curies. With a dose of 10 curies, the amount of quinones formed was 300 times more than the amount excreted in 24 hours. Excretion by yeast cells was also found to increase with increased dosage and time after irradiation. The postirradiation formation of quinone in potato tubers, corn germinants, corn seeds, and yeast are noted and compared. N.E.N.

N70-10912# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

QUINONE FORMATION IN THE LIVER OF IRRADIATED ANIMALS

Ye. G. Ptyshevskaya et al (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 refs (See N70-10908 01-04)

Avail: CFSTI

The initial quinone accumulation in the liver of irradiated white rats was studied quantitatively. Livers were removed 10-15 minutes, and 4, 24, and 48 hours after irradiation with 1 and 4 curies. The quinone accumulation was determined by polarographic and spectrophotometric methods. The accumulation was found to be greater with the higher dosage and to increase with time after irradiation. N.E.N.

N70-10913# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RADIATION ACTIVATION OF ENZYMATIC OXIDATION AND THE POSSIBLE ROLE OF THIS PROCESS IN THE FORMATION OF RADIOTOXINS OF QUINOID NATURE

A. M. Kuzin et al (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 44-48 refs (See N70-10908 01-04)

Avail: CFSTI

The radiation effect on the enzymatic oxidation of tyrosine by tyrosinase, leading to the formation of quinones and phenols, is investigated. The acceleration of enzymatic formation was found to increase up to a dose of 1000 r and to decrease with higher dosages. The phenol and quinone concentration in tyrosine solution was shown to increase linearly with dose. Results also indicate that the products of oxidation of tyrosine eliminate the induction period and directly affect the enzymatic reaction rate of the oxidation. N.E.N.

N70-10914# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INHIBITION OF DNA SYNTHESIS AFTER LOCAL IRRADIATION OF CYTOPLASM AND NUCLEUS

A. A. Vaynson et al (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 49-52 refs (See N70-10908 01-04)

Avail: CFSTI

The dose dependence of the inhibition of desoxyribonucleic acid synthesis in cytoplasm and the nucleus of HeLa cells was examined. The rate of synthesis was measured autoradiographically and was found to decrease with increased dose after local and total irradiation. It is concluded that the radiotoxin formation has significance in inhibition of DNA synthesis. N.E.N.

N70-10915# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE INTERACTION OF QUINONES WITH CELL NUCLEI

N. Ye. Lebedeva et al (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 53-59 refs (See N70-10908 01-04)

Avail: CFSTI

The existence of a rapid reaction of radiotoxins with chromosomes was studied in the enzymatic oxidation of tyrosine with rat thymus nuclei. The absorption spectra of tyrosine oxidation products were determined after 10, 15, 30, and 60 minutes of reaction at 30°C. Results indicate that the nuclei actively absorb quinones. Oxidation products of tyrosine were seen to be actively absorbed by thymus cell nuclei. The components responsible for the absorption were also investigated, and the bulk of quinones were found to be bound by deoxyribonucleoproteins, in which the quinones are about 80% associated with histones and the remaining part with DNA. N.E.N.

N70-10916# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RADIOMIMETRIC EFFECT OF ORTHO-QUINONES ON THE SORPTION PROPERTIES OF CELL NUCLEI

Ye. G. Ptyshevskaya et al (Inst. of Biophys., USSR Acad. of Sci.) *In* ITS Radiotoxins 17 Dec. 1968 p 60-65 refs (See N70-10908 01-04)

Avail: CFSTI

Fluorescent absorption spectra of rat thymus nuclei in the presence of acridine orange were measured. The effects of the intermediate quinone products of enzymatic tyrosine oxidation on the fluorescence of the nuclei were also studies. It was determined that fluorescence in the presence of acridine orange is duplicated by the products of enzymatic tyrosine oxidation. It was found that fluorescence is dependant upon the intermediate quinone products. Another experiment on irradiated rat liver showed the radiomimetic effect of quinones on fluorescence. N.E.N.

N70-10917# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE FORMATION OF COMPLEXES WITH THE TRANSFER OF A CHARGE BETWEEN NUCLEOTIDE BASES AND TETRACHLORO-p-BENZOQUINONE

A. M. Kuzin et al (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 66-72 refs (See N70-10908 01-04)

Avail: CFSTI

The interaction of tetrachloro-*p*-benzoquinone with guanine, guanosine, cytidine, and xanthine at various polarities of the medium was studied as a model system. Infrared and electron paramagnetic resonance spectroscopy of the reactions shows that nucleophilic substitution takes place by formation of complexes with charge transfer. The ability of the quinones to interact with nucleotide bases can have a great effect on a number of cellular processes, especially those related to transfer of genetic information. A chemical change in the matrix of deoxyribonucleic acid (DNA) has one of two consequences: either the DNA molecule loses the capacity for reduplication or this change may only disturb the correct reading of the sequence of nucleotide bases from DNA to informational ribonucleic acid (I-RNA). The genetic changes resulting from the action of the quinones is explained by interaction of these substances with the nucleotide bases of the DNA molecule. R.B.

N70-10918# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF RADIOTOXINS ON DEOXYRIBONUCLEIC ACID SYNTHESIS IN PLANTS

V. I. Tokarskaya et al (Inst. of Biophys., USSR Acad. of Sci.) *In*

its Radiotoxins 17 Dec. 1968 p 73–77 refs (See N70-10908 01-04)
Avail: CFSTI

Radiotoxins were extracted from irradiated potato tubers which were first subjected to gamma irradiation from a cesium 137 source. Three-day germinants of a radiosensitive pea variety were placed in extracts of the potato pulp. Two groups of peas were used as controls: one group was placed with their roots in tap water and the other in an extract of unirradiated tubers. After incubation in an atmosphere containing radioactive carbon dioxide, the plants were removed and homogenized, and after total radioactivity of the homogenate was determined, the deoxyribonucleic acid (DNA) was extracted from it. The specific activity of the extracted DNA was determined before hydrolysis with hydrochloric acid and the bases were separated quantitatively by paper chromatography. The adenine, thymine, guanine, and cytosine spots were eluted, and the amount of bases was determined from their ultraviolet absorption spectra. The experiments show that the radiotoxins formed in irradiated plant tissue not only cause inhibition of DNA synthesis by approximately 50% of the control group, but also affect the composition of newly synthesized DNA, decreasing its thymine content (and accordingly increasing the adenine/thymine ratio). R.B.

N70-10919# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF RADIOTOXINS FROM IRRADIATED PLANTS ON ANIMAL ASCITES CANCER CELLS
L. M. Kryukova (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 78–82 refs (See N70-10908 01-04)
Avail: CFSTI

Ascitic strains of rat ovary tumors and Ehrlich's mouse carcinomas were subjected to radiotoxins extracted from irradiated plant tissues. Contact action of the extracts on tumor cells studied *in vitro* show that most of them die within the first hour. Death of the cancer cells gradually increases in proportion to an increase in the time that they are in direct contact with the extracts of irradiated plants. The extracts were injected into animals infected with ascitic carcinomas to study their effect on mitotic activity. These *in vivo* studies show that cell division is inhibited within 24 hours after injection. After four to six subcutaneous injections not only is cell division inhibited, but the total amount of ascites and the concentration of cells in one milliliter of ascitic fluid are decreased. At the concentrations used, the extracts are not toxic to the animals. R.B.

N70-10920# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE COMPARATIVE EFFECT OF GAMMA-RAYS AND RADIOTOXINS OF QUINOID NATURE OF THE GROWTH LOACH ROE
G. V. Neustroyeu et al (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 83–89 refs (See N70-10908 01-04)
Avail: CFSTI

Fertilized loach roe were treated with extracts of quinone radiotoxins (RT) obtained from irradiated potato tubers and exposed to gamma radiation from a cesium 137 source to study the radiosensitivity of the roe at different stages of embryonic development. Results show that the roe are very sensitive to gamma radiation at 2.5 hours of development. Sensitivity drops sharply at 19 hours and then decreases slightly at 43 hours. Roe exposed to brief effects of large RT doses show no detectable difference in sensitivity at 2.5 and 19 hours, but sensitivity falls sharply at 43 hours. The number of developmental deformities from gamma radiation increases with dose rate and reaches 100% at one curie. Brief action of high RT concentrations produces the same effect, but the total number of deformities does not exceed 30 to 35% of surviving larvae. However, chronic action of small RT doses is very similar to the effect of gamma radiation. The hatching time of egg cells treated with RT concentrations is delayed at exposures of 43 hours, which is analogous to the effects of direct gamma radiation. R.B.

N70-10921# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF PLANT RADIOTOXINS ON THE ANIMAL ORGANISM
S. K. Melnikova et al (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 90–95 refs (See N70-10908 01-04)
Avail: CFSTI

Extracts of concentrated radiotoxins (RT) obtained from irradiated potato tubers were injected into mice to study changes in their weight. Three control groups were used: 1) uninjected mice; 2) injection of 0.2 ml of extract from unirradiated potato tubers; and 3) irradiation of the animals with 700 roentgens of cesium 137 gamma rays. A sharp drop in the animals' body weight is observed in the first two days after injection of plant RT, and subsequent growth lags considerably behind that of the unirradiated control groups. Total gamma radiation produced a pattern similar to plant RT through the first nine days of the experiment. High RT concentrations caused death in the animals. Twenty days after injection, the weight of the liver and testicles of the mice decreased by 17 and 18%, respectively, the weight of the kidneys remained unchanged, and the weight of the spleen increased by 33%. Similar changes in the weight of internal organs were produced by gamma and X-ray irradiation. Rats injected with the RT extracts displayed a sharp drop in the number of leukocytes during the first hours after injection, and continued to lag behind the control group after five days. R.B.

N70-10922# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE RECOVERY OF SEEDS FROM RADIATION INJURIES IN THE LIGHT OF THE TOXIN PRODUCTION THEORY
N. M. Berezina et al (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 96–101 refs (See N70-10908 01-04)
Avail: CFSTI

Air-dried corn seeds were irradiated with cesium 137 gamma rays to verify whether prolonged storage contributes to radiation recovery. One group of seeds was planted 24 hours after irradiation, another group 6 months and a third group after 2 years of storage at room temperature. The experiment was repeated with seeds stored after irradiation for 2, 3, and 4 years, and with freshly irradiated seeds. Germinants planted after 24 hours and 6 months storage died with little or no development after several days, while those stored for 2 years or more displayed normal development. It is concluded that post-radiation recovery after prolonged storage is due to elimination of the inflow into the embryo of quinone radiotoxins, which are the principal cause of retardation and death of irradiated seeds, rather than due to recovery of cytogenetic nuclear structures of the embryo damaged by direct radiation effects. R.B.

N70-10923# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RECOVERY OF GAMMA-IRRADIATED SEEDS FROM RADIATION INJURIES
V. A. Kopylov et al (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 102–107 refs (See N70-10908 01-04)
Avail: CFSTI

The hypothesis that washing irradiated corn seeds with water will remove toxic polyphenols produced by the irradiation

was examined. Washed and unwashed irradiated and nonirradiated seeds were grown under standard conditions. The washing, which lasted for two days at 4 to 6 C, was found to eliminate radiation inhibition almost completely. An anomaly of the washed irradiated seeds producing at the lowest number without panicles but the same amount of flowering is pointed out. It is suggested that quinones in large quantities are toxic, and in infinitesimal concentration they may act as a stimulant on some metabolic links although they are still toxic for the flowering phase. N.E.N.

N70-10924# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF PROTECTIVE SUBSTANCES ON THE YIELD OF SOME TOXIC PRODUCTS OF AMINO ACID RADIOLYSIS

N. A. Duzhenkova et al *In its* Radiotoxins 17 Dec. 1968 p 108–111 refs (See N70-10908 01-04)

Avail: CFSTI

Investigations on the products of amino acid and their inhibitors are reviewed. Emphasis on the products is on quinones and 3,4-dioxphenylalanine (3,4-DOPA) and emphasis on the inhibitors is on cysteine hydrochloride and propyigallate. Dependence of tyrosine decomposition and 3,4-DOPA accumulation on gamma ray dosage, and dependence of the protective effect of cysteine hydrochloride on concentration were found, and results are graphed. It is concluded that substances which are good acceptors of free radicals have a high protective effect and prevent the formation of toxic products. N.E.N.

N70-10925# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ROLE OF LIPID RADIOTOXINS IN THE TOXIC RADIATION EFFECT

Yu. B. Kudryashov (Dept. of Biophys., Moscow State Univ.) *In its* Radiotoxins 17 Dec. 1968 p 112–125 refs (See N70-10908 01-04)

Avail: CFSTI

The primary physiochemical changes, and the triggering mechanisms of radiation injuries in irradiated organisms is discussed in terms of the roles of various toxic substances in radiation lesion, and the establishment of the mechanisms in the toxic radiation effects. Changes in erythrograms of rats irradiated with different doses of gamma rays are analyzed. Lipid RT is considered to be a product of intensified decomposition of lecithin caused by irradiation of the cell. It is concluded that, ionizing radiation causes in irradiated organisms the production of toxic substances which intensify the radiation effect. Some of these are lipid RT, quinones, histamines, choline, and protein decomposition products. F.O.S.

N70-10926# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE CHEMICAL NATURE OF LIPID RADIOTOXINS AND THEIR DISTRIBUTION IN ORGANS AND TISSUES

T. A. Astakhova et al (Dept. of Biophys., Moscow State Univ.) *In its* Radiotoxins 17 Dec. 1968 p 126–132 refs (See N70-10908 01-04)

Avail: CFSTI

The hemolytic activity of the liver, intestine, stomach, kidneys, testicles, muscles, brain, omentum, and blood of irradiated rabbits were studied. The animals were irradiated with a dose of 800 r, and decapitated on the third day after irradiation. Removal of the tissues, their homogenization and extraction were carried out in a cold chamber. The chemical properties of the hemolytically active lipid RT was determined by chromatography. It is concluded that lipit RT is an unsaturated fatty acid and represents a complex mixture of these substances. F.O.S.

N70-10927# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE FREE RADICAL STATE OF LIPID RADIOTOXINS

Z. Ya. Baltbarzdys et al (Dept. of Biophys., Moscow State Univ.) *In its* Radiotoxins 17 Dec. 1968 p 133–137 refs (See N70-10908 01-04)

Avail: CFSTI

The behavior as free radicals of lipid toxic substances produced during irradiation of animals is studied. White male mice served as the animals for investigation. The animals underwent one general irradiation with a dose of 800 r. The presence of free radicals was judged by acrylamide polymerization, and it was established that maximum copolymerization with natural tissues begins after four hours. The free radical states of natural radiomimetic (NR) was studied in the liver. It was found that immediately after irradiation the concentration of free radicals was five to six times the normal rate; however, the concentration decreases sharply in the first 24 hours. It is concluded that the NR of irradiated animals is a mixture of unsaturated fatty acids which contain different oxidation products capable of exciting luminescence in the methanol-sodium citrate system. F.O.S.

N70-10928# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE FORMATION OF LIPID RADIOTOXINS IN ANIMALS AFTER IRRADIATION WITH FISSION NEUTRONS, HIGH ENERGY PROTONS AND Co 60 GAMMA-RAYS

A. G. Konoplyannikov et al *In its* Radiotoxins 17 Jul. 1969 p 138–143 refs (See N70-10908 01-04)

Avail: CFSTI

The significance of various toxic products of a lipid nature in the development of radiation injury is analyzed by comparing the effects of different types of ionizing radiation in equivalent doses. White male rats were irradiated with 600 MeV protons, and fission neutrons in equivalent lethal doses of 800 rem. Rabbits were irradiated with 130 MeV protons, fission neutrons and Co-60 gamma rays in equivalent doses of 1000 rem. Results on the accumulation of lipid oxidation products are presented in graphs. It is concluded that: (1) The accumulation of lipid oxidation products in the liver of rats irradiated with equivalent doses of different types of radiation takes place in the same way. (2) The activity of NR isolated from the liver of rabbits irradiated with equivalent doses of different types of radiation is also approximately the same. F.O.S.

N70-10929# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE LIPID RADIOTOXINS OF YEAST CELLS

V. Olteanu et al (Dept. of Biophys., Moscow State Univ.) *In its* Radiotoxins 17 Dec. 1968 p 144–150 refs (See N70-10908 01-04)

Avail: CFSTI

The toxic lipid products accumulation after irradiation by different doses of ionizing radiation in haploid and diploid yeast cells was studied. The techniques and procedures of the experiment are described, including the growth of the cells, irradiation, and extraction of the lipids. It is concluded that: (1) After gamma irradiation of diploid and haploid yeast cells, toxic lipid products are produced. (2) The activity of lipid radiotoxins (RT) isolated from diploid yeast cells increases with an increase in the irradiation dose. (3) Incubation of irradiated cells in nutrient medium leads to an increase in the activity of the lipid RT extracted from them. (4) Incubation of irradiated yeast cells in tap water has little effect on the activity of the lipid RT. (5) Lipid RT isolated in experiments with yeast cells give a specific reaction to products of unsaturated fatty acid oxidation. F.O.S.

N70-10930# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE SPECIFICITY OF THE PRODUCTION OF TOXIC LIPID SUBSTANCES (THE EFFECT OF VIBRATION, ELECTRONARCOSIS AND RADIATION)

Yu. B. Kudryashov et al (Dept. of Biophys., Moscow State Univ.) *In its* Radiotoxins 17 Dec. 1968 p 151–156 refs (See N70-10908 01-04)

Avail: CFSTI

The effect of electrical narcosis and vibration ion radiation injury, and the changes in the production of toxic lipid substances were studied in white male rats. The techniques and procedures of the experiment are described. It is concluded that: (1) Electronarcosis and vibration cause a drop in the oxidation and reduction potential, and a prolonged decrease in the oxygen level in tissues. (2) The effect of stress agents is the production of toxic substances, however, their production is short-lived. (3) The specificity of the production of toxic lipid substances after the irradiation lies in the fact that in radiation injury, in contrast to the effect of electronarcosis and vibration, the production of lipid radiotoxins increases with time. The experimental data are summarized in tables. F.O.S.

N70-10931# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE JOINT EFFECT OF RADIATION AND AN UNSATURATED FATTY ACID ON ERYTHROCYTES

Yu. B. Kudryashov et al (Dept. of Biophys., Moscow State Univ.) *In its* Radiotoxins 17 Dec. 1968 p 157–160 refs (See N70-10908 01-04)

Avail: CFSTI

The hypothesis that primary lipid radiotoxins (RT) cause radiation injury in living irradiated cells is investigated by studying the effect of radiation and oleic acid on erythrocytes. A suspension of erythrocytes in oleic acid was irradiated and incubated. At different time intervals the change in the stability of the erythrocytes to a standard hemolytic agent, hydrochloric acid was examined. The experimental data are summarized in tables, and indicate that in the presence of oleic acid an intensification of the radiation effect on erythrocytes occurs. Further experimentation is recommended to explain the effects of the disturbances which occur in the irradiated erythroycytes. F.O.S.

N70-10932# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE TOXICITY OF LIPIDS IN ANIMAL RADIATION SICKNESS

M. L. Kakushkina (Dept. of Biophys., Moscow State Univ.) *In its* Radiotoxins 17 Dec. 1968 p 161–168 refs (See N70-10908 01-04)

Avail: CFSTI

A review of the literature concerning the influence of various toxic lipids on the development of radiation injuries of living organisms is presented. The overall conclusions of the review are: (1) The effect of oleic acid on erythrocytes depends on its oxidation, as well as on its fixation on cellular structures. (2) After irradiation of rabbits an increase occurs in the toxic properties of the liver lipids in acting on erythrocytes as well as on isolated mitochondria. (3) An increase in the toxicity of the lipids occurs both in the first two to four hours after the effect and immediately before the death of the animals. The rate of enzymatic autolytic processes increases in the first period after the effect and is lower than normal before the animal's death. F.O.S.

N70-10933# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MORPHOLOGICAL AND HISTOCHEMICAL CHANGES IN THE ORGANS OF ANIMALS SUBJECTED TO THE ACTION OF LIPID RADIOTOXINS

Ye. A. Shubnikova et al (Moscow State Univ.) *In its* Radiotoxins 17 Dec. 1968 p 169–188 refs (See N70-10908 01-04)

Avail: CFSTI

The highly radiosensitive rat organs were examined after: (1) irradiation with 880 r of gamma radiation, (2) 600 rad of fast neutron, and (3) the injection of lipid radiotoxins obtained from the livers of irradiated rabbits. Morphological and cytochemical changes in cell structure, ribonucleic acid, and lipid metabolism were studied by cytological and histochemical methods. In all the tissues studied both from radiation and from injection of RT, structural changes in the mitochondria and conglomeration, swelling or disappearance of the injured cell were observed. These cytological and cytochemical changes in cells are considered similar to the effect of gamma and neutron irradiation, and the injection of lipid radiotoxins. F.O.S.

N70-10934# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE CYTOGENETIC EFFECT OF LIPID RADIOTOXINS

N. G. Labzina et al (Moscow State Univ.) *In its* Radiotoxins 17 Dec. 1968 p 189–194 refs (See N70-10908 01-04)

Avail: CFSTI

The reaction of natural radiomimetic toxic lipids, in the cells of irradiated organisms, with the genetic material resulting in aberrations, or causing the manifestation of the already present hidden defects is investigated in Ehrlich's escites carcinoma cells and in loach ova. It is concluded that OOA in causing chromosomal aberrations in cancer cells is a developer of hidden defects existing in these cells. OOA does not have an effect on uninjured chromosomes of normal cells, but does take part in the initial reactions of radiation injury. F.O.S.

N70-10935# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE TOXIC EFFECT OF WATER-SOLUBLE OXIDATION PRODUCTS OF IRRADIATED LINOLENIC ACID

A. S. Mochalina *In its* Radiotoxins 17 Dec. 1968 p 195–200 refs (See N70-10908 01-04)

Avail: CFSTI

Thiobarbituric acid was used to demonstrate the production of water soluble unsaturated fatty acid oxidation products in biological cells after irradiation. Aqueous extracts of irradiated oxidized linolenic acid products interacted with thiobarbituric acid by forming colored solutions with an optical density of 532 millimicron for green filter and of 455 millimicron for blue filter measurements. Characteristic absorption spectra of the colored solution established a direct relationship between the rose color intensity and the total dose of gamma-irradiation. The yield of linolenic acid products responsible for bands at 532 m and at 455 m increased with an increase in the dosage. In order to test the effects of radiative chemical oxidation of unsaturated fatty acids in the development of radiation injuries, elutes were tested on mouse erythrocytes and the infusoria 'Paramecium caudatum.' Results showed that water soluble linolenic acid oxidation products had a hemolytic effect and caused inhibition of parametric division. With an increase in the linolenic acid irradiation dose the toxic effect of these products increased and death of the infusoria occurred. G.G.

N70-10936# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RATE OF ACCUMULATION AND INTERRELATION OF LIPID RADIOTOXINS AND QUINONES

A. M. Kuzin et al (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 201–206 refs (See N70-10908 01-04)

Avail: CFSTI

Biological effects of lipid radiotoxins and quinones and their interrelation characteristics in irradiated organisms were studied on rat and rabbit livers and tissues. Results showed that: (1) quinone

and lipid radiotoxins isolated from the tissues did not contain toxically active impurities; (2) phase variations in liver quinone levels at different periods of acute radiation sickness and a gradually increasing lipid radiotoxin level were observed; (3) lipid radiotoxin injection into animals caused a change in quinone level of the liver similar to that which occurred from the effect of ionizing radiation; and (4) quinone extract injections into animals did not change the level of toxic lipid substances. G.G.

N70-10937# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE MECHANISM OF DAMAGE TO THE SUPERFICIAL ERYTHROCYTE LAYER BY UNIRRADIATED AND IRRADIATED UNSATURATED FATTY ACIDS

K. S. Trincher et al (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 207–213 refs (See N70-10908 01-04)

Avail: CFSTI

Toxic effects of radiation and radiation products on rat blood erythrocytes were studied. Irradiated erythrocyte suspensions as well as erythrocyte suspensions incubated with unsaturated fatty acids and then subjected to irradiation under oxidation conditions were analyzed by photocolorimetric density measurements. Kinetic curve shifts in percentages relative to the position of a control curve served as measure of erythrocyte damage. Results showed that: (1) injury of erythrocytes by unsaturated fatty acids was controlled by the law of the kinetics of a zero order chemical reaction; injuries to erythrocytes suspended in physiological solution occurred according to Poisson statistics; (2) maximal concentrations of oleic, linolenic, and olinoleic acids causing 100% injuries were in the range of $(18-22) \times 0.000001$ g/ml; at this concentration the surface of the erythrocyte was completely covered with unsaturated fatty acid molecules; and (3) gamma irradiation of linolenic acid in doses of 10 to 20 kr increased hemolytic activity not connected with the peroxide content. G.G.

N70-10938# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CHOLINE PRODUCTION IN ANIMAL RADIATION SICKNESS

O. S. Arutyunova et al (Dept. of Biophys., Moscow State Univ.) *In its* Radiotoxins 17 Dec. 1968 p 214–219 refs (See N70-10908 01-04)

Avail: CFSTI

Changes in the level of free and total choline, as well as its connection with the production of other lipid radiotoxins during radiation sickness were studied on white rats. Oxidized oleic acid preparations were injected intraperitoneally and test organs were extracted after irradiation and the amount of choline determined. Phase changes in total and free choline level were already observed after a dose of 800 r. Total choline increased during the the first period of radiation sickness in the spleen, liver, and kidneys of the animals whereas a decrease was observed in skeletal and cardiac muscles. Further increases in free choline level and decrease of total choline level during progressing radiation sickness were attributed to intensified autolytic processes in tissues. An injection of lipid radiotoxins triggered phase changes in the amount of liver choline. G.G.

N70-10939# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE CHANGE IN THE FREE HISTAMINE LEVEL IN RAT TISSUES FROM THE EFFECT OF PHYSICAL AND CHEMICAL FACTORS

J. G. Bilushi et al (Dept. of Biophys., Moscow State Univ.) *In its* Radiotoxins 17 Dec. 1968 p 220–225 refs (See N70-10908 01-04)

Avail: CFSTI

The dynamics of free, biologically active histamine accumulations were studied during radiation sickness and after injection of unsaturated fatty acid oxidation products in order to determine the relationship between lipid radiotoxins and the histamine level. Injection of oleic acid oxidation products in rats caused phase changes in the free histamine content of organs and tissues with sharp inhibition of histaminopexic capacity; injection with lipids isolated from irradiated rabbit livers changed the free histamine level similar to radiation induced disturbances. It was concluded that lipid radiotoxins increased the production of histamine during radiation sickness. G.G.

N70-10940# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ROLE OF INCREASED SENSITIVITY TO A NUMBER OF BIOGENIC FACTORS IN THE DEVELOPMENT OF RADIATION TOXEMIA

Ye. I. Krichevskaya et al (USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 226–231 refs (See N70-10908 01-04)

Avail: CFSTI

The synergetic effect of ionizing radiation and natural radiomimetic on mice and rats was studied by determining the change in sensitivity of their cholinergic receptors to carbocholine and histamine. Results showed that: (1) ionizing radiation caused an increase in rat sensitivity to carbocholine and histamine; (2) increased sensitivity to histamine was attributed to the suppression of histaminopexic tissue capacity and to a disturbance of the penetrability of the hemato-encephalic barriers for histamine; and (3) absence of the same radiation reaction in mice gave an example of species specifity. G.G.

N70-10941# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PARTICIPATION OF CERTAIN BIOLOGICALLY ACTIVE SUBSTANCES IN RADIATION DISTURBANCES OF THE PENETRABILITY OF THE HISTO-HEMATIC BARRIERS

Ye. N. Gon Charenko (USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 232–236 refs (See N70-10908 01-04)

Avail: CFSTI

The effects of lipid radiotoxins on the penetrability of histo-hematic barriers and their connection with free, biologically active histamine were studied on liver, muscles, and brains of irradiated rabbits. Radioactive phosphorus isotope was used as indicator and the ratio of tissue radioactivity to the radioactivity of blood was the index of penetrability. During the first period of radiation sickness an increase of tissue penetrability took place which decreased in the ensuing period. Injection of lipids isolated from tissues of irradiated animals had a definite radiometric effect on histo-hematic barrier penetrability; in the initial period of radiation sickness penetrability increased but fell sharply below normal during the most acute form of the illness. Changes in penetrability depended on radiation dosage as well as on the content of oxidized products in the lipid radiotoxin. In comparison the rate of decrease in histamine level, just after irradiation, was different in different organs. Histaminopexic capacity of the tissues of animals injected with lipid radiotoxins also decreased during the entire period of illness. It was concluded that lipid radiotoxins from organisms of irradiated animals change the level of free biologically active histamine and aggravate radiation sickness. G.G.

N70-10942# Air Force Systems Command, Wright-Patterson, AFB, Ohio. Foreign Technology Div.

SOME DATA ON THE NATURE OF TOXIC FACTORS IN RADIATION SICKNESS

P. D. Gorizontov et al *In its* Radiotoxins 17 Dec. 1968 p 237–249 refs (See N70-10908 01-04)

Avail: CFSTI

The role of the protein component in onset and development

of radiation toxemia was studied by analysing the morphological composition of tissue fluids of irradiated dogs with emphasis on the biological effect of the globulin fraction on hemopoiesis and immunobiological reactivity. Immunobiological reactivities were considerably inhibited during irradiation: the skin's bactericidal capacity was decreased, the phagocytic activity of blood neutrophils suppressed, and lysozyme production in the saliva decreased. Increased cytolytic activity in a perfusate of irradiated tissues was considered as washing out of antibodies against cells which were antigenically changed. Injection of gamma globulin from irradiated dogs into healthy animals caused a similar decrease of immunobiological activity as observed in radiation sickness; it was concluded that the toxemic factor in radiation sickness can be the globulin fraction of the irradiated organism's blood. G.G.

N70-10943# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PARTICIPATION OF HUMORAL TOXIC AGENTS IN THE DEVELOPMENT OF SOME SYNDROMES OF RADIATION SICKNESS

A. G. Sverdlov (USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 250–255 refs (See N70-10908 01-04)

Avail: CFSTI

The pathogenetic role of radiotoxins in syndromes of radiation sickness was investigated; emphasis was placed on the effects of toxic factors in relatively unexplored aspects of the disease, since much study has already been devoted to changes in the morphological composition of the blood and organs of hemogenesis caused by irradiation. Intact rabbits were injected intravenously with perfusates of an irradiated rabbit femur, which was isolated in a vascular respect from the organism, while control experiments were run simultaneously using perfusates of an unirradiated femur. Results indicated that the manifestations of toxicity are numerous and varied, as are the toxins themselves. It is assumed that in addition to a direct effect on cells and tissues, the toxins participate in autosensitization of the organism, as well as in disturbances in the neuroendocrine regulation. Further analyses of these preliminary findings are recommended. A.C.R.

N70-10944# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ROLE OF RADIOTOXINS IN ANIMAL RADIATION SICKNESS

S. P. Yarmonenko (USSR Acad. of Med. Sci.) *In its* Radiotoxins 17 Dec. 1968 p 256–263 refs (See N70-10908 01-04)

Avail: CFSTI

Considerations concerning the possible role of radiotoxins in the direct and remote effects of irradiation are presented. A comparative study was made of the effect of ionizing radiation and radiomimetic agents of the alkylating type to determine the validity of an hypothesis that the biological effect may be caused not only by short-lived radicals, but also by more stable intermediate products of their further conversions, whose manifestations are imitated by radiomimetics. Experiments using frogs and mice indicate a similar lethal effect in doses of X-rays and HN_2 and NH_2; these results therefore give further support to the theory, although the nature of the reaction within the animal's cellular structure differs. Investigations of radiotoxins and the remote results of radiation led to the conclusion that humoral factors which determine the development of the remote effect can have quite a different origin than that of the local radiotoxins. The development of these factors in early stages of the illness evidently is due to a disorder of the neuroendocrine regulation and later to a disturbance in metabolism. A.C.R.

N70-10945# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE MUTAGENIC EFFECT OF EXTRACTS OF VARIOUS ORGANS OF IRRADIATED MICE

Yu. Ya. Kerris et al (USSR Acad. of Sci., Novosibirsk) *In its* Radiotoxins 17 Dec. 1968 p 264–269 refs (See N70-10908 01-04)

Avail: CFSTI

Experiments were conducted using 367 brown mice to determine in which of the irradiated organs the production or accumulation of active substances occurs. The following conclusions were reached: (1) Water-salt extracts from the brain of irradiated mice demonstrate a reliable cytogenetic effect when injected into intact recipients. (2) A similar but statistically unreliable result appeared after injecting a fatty tissue extract. Extracts of intestine, liver, testicles, and spleen, as well as heparinized blood, did not produce an effect. (3) The extracts proved effective only when the organs were irradiated in situ. (4) The observed remote mutagenic effect of radiation may possibly be caused by products of biolipid radiolysis which develop in the irradiated organism. Future studies to determine the relative significance of the resulting chemical mutagenesis following irradiation at different dosages are recommended. A.C.R.

N70-10946# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE REMOTE EFFECT OF RADIATION ON THE HEMOPOIETIC ORGANS

A. L. Vygodskaya et al (Inst. of Biophys. USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 270–274 refs (See N70-10908 01-04)

Avail: CFSTI

Results of studies into the remote effects of radiation in the hemopoietic organs, which are highly radiosensitive and are responsible for the damage at average lethal doses, are reported. Included are investigations of the relative role of the remote effect of ionizing emissions in general radiation injury, the possible mechanisms of this effect, and theoretical hypotheses for reducing such damage. Reactions in unbred, pubescent, male rats of different weights, kept in a normal environment and under the usual diet, were recorded from irradiation of a number of bone marrow karyocytes. Full irradiation and exposure of shielded extremities led to the general conclusion that under ordinary experimental conditions the number of bone marrow karyocytes is sharply decreased in the shielded extremity. A prophylactic injection of protector somewhat decreases this injury. A careful analysis of the contribution made by nonspecific reactions is necessary to obtain information concerning the influence of the true remote effect. A.C.C.

N70-10947# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ROLE OF THE METABOLIC PROPERTIES OF REGENERATING TISSUES IN RESISTANCE TO IONIZING RADIATION

M. F. Popova (Inst. of Animal Morphol., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 225–279 refs (See N70-10908 01-04)

Avail: CFSTI

The radioresistant characteristics of tissues during development of a plastic regenerative condition was examined in normal and regenerating corneal epithelia. The data indicate that the regenerative process not only promotes elimination of the dead cells of irradiated tissue, but also provides for its increased radioresistance. Studies of specific metabolic properties of regenerating tissues were carried out as related to the dynamics of their radioresistance, and attention was also focused on the radio-protective role of sulfhydryl compounds. The results of the various experiments indicate a close relationship between radioresistance and the metabolic functions; as a result of the latter function in regenerating tissues, conditions are created which decrease radiotoxin production and the consequent

injurious effect of radiation. It appears possible that during regeneration processes conditions are created in the tissues which promote recovery processes both at the tissue and cellular levels. A.C.R.

N70-10948# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A STUDY OF THE ROLE OF TOXINS IN RADIATION DAMAGE OF COTTON PLANTS BY MEANS OF GRAFTS

N. N. Nazirov et al (Inst. of Exptl. Plant Biol., UzSSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 280-286 refs (See N70-10908 01-04)
Avail: CFSTI

Since grafting of an irradiated plant or one of its organs to an unirradiated plant provides a convenient method of determining the role of metabolic changes in the irradiated organism and of the toxic metabolic products formed as a result, an experiment was conducted using cotton plants of the variety Gossypium hirsutum L. Plants grown from ordinary seeds were grafted onto those grown from Cobalt-60 irradiated seeds of the same variety and vice versa. The following determinations were then made: (1) effect of irradiated and unirradiated rootstock on scion's growth and development; and (2) effect of irradiated and unirradiated rootstock on boll size and raw cotton yield in the scion. An interesting phenomenon was also observed in the deformation of bolls both in the scion and in the rootstock resulting from the remote effect of radiotoxins. A.C.R.

N70-10949# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PROPERTIES OF A RADIOTOXIC SUBSTANCE SUFFICIENT TO CAUSE DEATH OF MAMMALS 30 DAYS AFTER IRRADIATION

V. I. Suslikov (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 287-293 refs (See N70-10908 01-04)
Avail: CFSTI

An investigation was made to determine the possible properties of the radiotoxic substance which plays the decisive role in developing processes leading to the death of irradiated animals in the first 30 days following exposure. Results of fractionated irradiation with sublethal doses are presented, indicating that the probability of death decreases with an increase in the time interval between the two fractions. It is assumed that reparation caused by the first irradiation occurs in the time between the two exposures, so that the second dose does not add to the initial one, but to its decreased value remaining at the point of application of the second dose. This decrease is defined as the residual dose, and within the framework of this model, the following natural properties are assigned to the radiotoxic substance: (1) The amount of toxic substance formed is directly proportional to the dose in the range from zero to several thousand R. (2) The time in which the amount of toxic substance reaches its maximum value does not depend on the dose and the site of its production. (3) After reaching maximum value, the amount of the substance decreases with time at a rate proportional to its concentration. (4) The organism dies only when the total amount of toxic substance in the entire body reaches some threshold value. A.C.R.

N70-10950# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PARTICIPATION OF RADIOTOXINS IN RADIATION'S REMOTE EFFECT

L. M. Kryukova et al (Inst. of Biophys., USSR Acad. of Sci.) *In its* Radiotoxins 17 Dec. 1968 p 294-310 refs (See N70-10908 01-04)
Avail: CFSTI

Experiments on sunflower plants were conducted to determine the presence of biologically active substances, or radiotoxins which kill ascites cancer cells, in shielded leaves following irradiation of the scar of the removed upper bud. The results confirm an hypothesis that the remote effect of irradiation on the entire plant, as manifested in the form of morphological deviations, is caused by radiotoxins flowing into the unirradiated portions from the locally-exposed sites. A.C.R.

N70-10964# Oak Ridge National Lab., Tenn.

PRIMARY LITERATURE IN THE FIELD OF RADIATION PROTECTION

H. Scheel [1969] 32 p refs Transl. into ENGLISH of Staatliche Zentrale fuer Strahlenschutz, Berlin (East Ger.) Report SZS-17/68 Prepared by Sci. Transl. Serv., Ann Arbor, Mich.
(ORNL-tr-2152; SZS-17/68) Avail: CFSTI

Citation data obtained from two volumes of Health Physics and Giornale di Fisica Sanitaria e Protezione Contro le Radiazioni were used to survey the literature in the field of radiation protection. The results showed that: nearly 60% of all citations were derived from journals, about 20% of all cited journals contained 75% of journal citations; journals of medicine and biology were most frequently cited; most of the cited journals were published in the U.S.A.; about 50% of all citations were not older than 5 and about 80% not older than 10 years; and there are two components of literature, the classic and the ephemeral. Author (NSA)

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SECOND PROGRAMMING COURSE ON THE APPLICATIONS OF ELECTRONIC COMPUTERS IN BIOLOGY AND MEDICINE, 10 SEPTEMBER-14 DECEMBER 1968. PART 7: MATHEMATICAL EXERCISES, 2 [2 CORSO DI PROGRAMMAZIONE, ORIENTATO VERSO LE APPLICAZIONI DEI CALCOLATORI ELETTRONICI ALLA BIOLOGIA E ALLA MEDICINA, 16 SETTEMBRE-14 DICEMBRE 1968. PARTE 7: ESERCITAZIONI DI MATEMATICA, 2]

20 Jan. 1969 76 p In ITALIAN; ENGLISH summary
(ISS-69/6) Avail: CFSTI

This part of a series of lecture notes is relative to a programming course on the applications of electronic computers in biology and medicine. It contains some exercises solved during the course. Functions, their limits and graphs, trigonometric equations, derivatives, integrals and differential equations are given. Author

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SECOND PROGRAMMING COURSE ON THE APPLICATIONS OF ELECTRONIC COMPUTERS IN BIOLOGY AND MEDICINE, 16 SEPTEMBER-14 DECEMBER 1968. PART 8: STATISTICAL METHODS IN BIOLOGY AND MEDICINE, 1 [2 CORSO DI PROGRAMMAZIONE, ORIENTATO VERSO LE APPLICAZIONI DEI CALCOLATORI ELETTRONICI ALLA BIOLOGIA E ALLA MEDICINA, 16 SETTEMBRE-14 DICEMBRE 1968. PARTE 8: METODI STATISTICI IN BIOLOGIA E MEDICINA, 1]

25 Jan. 1969 78 p In ITALIAN; ENGLISH summary
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This part of a series of lecture notes is relative to a programming course on the applications of electronic computers in biology and medicine. It contains a brief description of the elements of descriptive statistics and probability theory which are needed for using statistical methods in research. Author

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SECOND PROGRAMMING COURSE ON THE

APPLICATIONS OF ELECTRONIC COMPUTERS IN BIOLOGY AND MEDICINE, 16 SEPTEMBER – 14 DECEMBER 1968. PART 9: STATISTICAL METHODS IN BIOLOGY AND MEDICINE, 2 [2 CORSO DI PROGRAMMAZIONE, ORIENTATO VERSO LE APPLICAZIONI DEI CALCOLATORI ELETTRONICI ALLA BIOLOGIA E ALLA MEDICINA, 16 SETTEMBRE – 14 DICEMBRE 1968. PARTE 9: METODI STATISTICI IN BIOLOGIA E MEDICINA, 2]

25 Jan. 1969 66 p In ITALIAN; ENGLISH summary
(ISS-69/8) Avail: CFSTI

This part of a series of lecture notes relative to a programming course on the applications of electronic computers in biology and medicine contains an elementary description of the statistical methods which are based on the analysis of the frequencies and an introduction to the general linear model. Author

N70-10995# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

SECOND PROGRAMMING COURSE ON THE APPLICATIONS OF ELECTRONIC COMPUTERS IN BIOLOGY AND MEDICINE, 16 SEPTEMBER – 14 DECEMBER 1968. PART 10: STATISTICAL METHODS IN BIOLOGY AND MEDICINE, 3 [2 CORSO DI PROGRAMMAZIONE, ORIENTATO VERSO LE APPLICAZIONI DEI CALCOLATORI ELETTRONICI ALLA BIOLOGIA E ALLA MEDICINA, 16 SETTEMBRE – 14 DICEMBRE 1968. PARTE 10: METODI STATISTICI IN BIOLOGIA E MEDICINA, 3]

25 Jan. 1969 67 p In ITALIAN; ENGLISH summary
(ISS-69/9) Avail: CFSTI

This part of a series of lecture notes is relative to a programming course on the applications of electronic computers in biology and medicine. This report contains a description of the statistical problems dealing with the analysis of variance and of some relevant nonparametric methods. Author

N70-11006# Georgia Inst. of Tech., Atlanta. Office of Information Science.

REDUCTIONISTIC INFERENCES IN MODERN BIOLOGY

Lucio Chiaraviglio 1969 32 p refs
(Grant NSF GN-655)
(PB-185403; GITIS-69-05) Avail: CFSTI CSCL 06C

The examples of inferences that are considered span classical and molecular genetics. The principal aim of these inferences is to correlate the phenotypic and genotypic properties, functions, and structures of organisms to their molecular machinery. The inferences are reductionistic bridges between the organic and molecular levels of explanation. The proposal that a gene is a set of contiguous loci of bases in the polymers that are the genetic materials has gained part of its acceptance through a large set of inferences that relate classical genetic structures, map structures, to the structures of these polymers. Most often the evidence for such inferences comes from viral and bacterial systems. The discovery and elucidation of some of the principal structures of macromolecules such as proteins, DNA, and RNA have been obligatory steps in the reductionistic development. Similarly the elucidation of the genetics of organisms which reproduce rapidly and thus are well suited to fine structure exploration of genetic maps was required. USGRDR

N70-11188# Sensory Systems Lab., Tucson, Ariz.

BIOTELEMETRY ULTRASONIC TECHNIQUES

Howard A. Baldwin, Donald L. Brumbaugh, and Dale E. Hall Jun. 1969 18 p refs
(Contract Nonr-4315(00))
(AD-691897) Avail: CFSTI CSCL 6/2

Several electronic circuit designs and harness techniques for telemetry of physiological data from free swimming aquatic animals are presented. Included are instruments for transmission of diving depth, heart and muscle potentials and heart sounds. Author (TAB)

N70-11203# Systemed Corp., Dayton, Ohio.

THE ACUTE INHALATION TOXICITY OF MONOMETHYLHYDRAZINE VAPOR Technical Report, Feb. 1966 – Nov. 1967

C. C. Haun, J. D. Mac Ewen, E. H. Vernot, and G. F. Egan Wright-Patterson AFB, Ohio USAF Apr. 1969 53 p refs
(Contract F33615-67-C-1025)
(AD-691240; W-68003; AMRL-TR-68-169) Avail: CFSTI CSCL 6/20

The lack of adequate data and the increased use of monomethylhydrazine (MMH), a rocket propellant, prompted additional studies of the acute inhalation toxicity of this compound. The reactive nature of MMH necessitated the use of modified test systems designed to minimize the degradation of MMH during animal exposures. Rats, mice, beagle dogs, squirrel monkeys, and rhesus monkeys were exposed to various measured concentrations of MMH vapor for specified time periods. Rodents were exposed for 30-, 60-, 120-, and 240-minute periods; dogs and squirrel monkeys, for 15, 30, and 60 minutes; and rhesus monkeys for 60 minutes only. The toxicity of MMH for the five animal species was defined by determinations of LC50 values, pathology examination of organs, observations of symptoms, measurements of body weight in rats and mice, and blood chemistry and hematology tests on dogs and rhesus monkeys. Squirrel monkeys proved to be the most sensitive and rats the least sensitive to the lethal effects of MMH. MMH exposure produced definite hemolytic changes in dogs and, to a lesser extent, in rhesus monkeys. These experiments show MMH to be a highly toxic compound. Studies are currently in progress to determine the level at which MMH produces no irreversible injury. Author (TAB)

N70-11206*# Midwest Research Inst., Kansas City, Mo.

THE APPLICATION OF AEROSPACE TECHNOLOGY TO BIOMEDICAL PROBLEMS Quarterly Report, 15 Jun. – 31 Aug. 1969

David Bendersky and Donald E. Roberson 31 Aug. 1969 35 p refs
(Contract NASw-1936; MRI Proj. 3332-E)
(NASA-CR-106734; QR-1) Avail: CFSTI CSCL 06E

The biomedical applications team (BAT) activities in facilitating the technology utilization of aerospace developments in biomedicine are reported. The status of biomedical problems under consideration including the potential transfers, and a summary of active problems are included. It is considered noteworthy that six of eleven potential transfers were found in manual searches in the MRI-BAT document files, and is indicative of the growing accumulation of pertinent documents in the files. Since it was concluded that the number of transfers is in direct proportion to the number of participating medical institutions, and the number of biomedical problems submitted by the medical institutions, it was decided to increase the number of participating medical institutions. F.O.S.

N70-11224# Scientific Translation Service, Ann Arbor, Mich.

CATALASE ACTIVITY DURING MUSCULAR ACTIVITY IN BIRDS [AKTIVNOS KATALAZY V PROTSESSE MYSHECHNOI DEYATELNOSTI U PTITS]

G. I. Rogachev Aug. 1969 9 p refs Transl. into ENGLISH from Tr. Bashkirskii Selskokhozyaistvennyi Inst. (USSR), v. 12, no. 3, 1966 p 83 – 87 Sponsored by AEC Prepared for Argonne Natl. Lab., Ill.
(PB-185576T; ANL-Trans-768) Avail: CFSTI CSCL 06P

The individual constant of catalase activity in the muscles of various pigeons is different. Expressing the catalase activity in milliliters of 0.1 N hydrogen peroxide decomposed by catalase, we find a minimum of 383.4 ml and a maximum of 874.0 ml, and an average of 615 ml. In pigeons, catalase activity during muscle exercise shows a significant rise. Fatiguing work causes a significant increase in catalase activity in the muscles and in

previously exercised muscles of pigeons; the same amount of fatiguing work significantly increases the catalase activity in pigeons by approximately 30% or more against the resting figures. Author (USGRDR)

N70-11279*# Research Triangle Inst., Durham, N.C. Engineering and Environmental Sciences Div.
BIOMEDICAL APPLICATIONS OF NASA SCIENCE AND TECHNOLOGY Quarterly Progress Report, 15 Jun.–14 Sep. 1969
14 Sep. 1969 69 p refs
(Contract NASw-1950)
(NASA-CR-106733; RTI-EU-468; QPR-1) Avail: CFSTI CSCL 06E

A biomedical applications team presents an experimental program in technology transfer. Significant transfers of technology include a material for hip joint prothesis developed from low friction space bearings, electromyography in hand rehabilitation, and the development of cardiotachometer circuitry. New investigations include: electroencephalogram and underwater telemetry; measurement of isethionic acid and measurement of calcium; development of a urine disposal unit; a pressure suit for orthostatic hypotense patients; percutaneous tubes for blood dialysis; lightweight cast and splinting material; transducers to measure finger displacement, force, and intracellular pressure; an automatic control for a tilt bed; a motion force amplifier; cardiovascular correlation techniques; and an eye movement measuring device. Author

N70-11390# Naval Aerospace Medical Inst., Pensacola, Fla.
DYNAMIC RESPONSE OF THE HEAD AND NECK OF THE LIVING HUMAN TO –G SUB X IMPACT ACCELERATION. 1. EXPERIMENTAL DESIGN AND PRELIMINARY EXPERIMENTAL DATA
Channing L. Ewing, Daniel J. Thomas, George W. Beeler, Jr., Lawrence M. Patrick, and David B. Gillis 26 Mar. 1969 25 p refs
(AD-692069; NAMI-1064; USAARL-69-6) Avail: CFSTI CSCL 6/2

A study is underway to determine the dynamic response of the head and neck of living human subjects to –Gsub x impact acceleration, using transducers to measure differential displacements and differential angular and linear accelerations of the head with reference to the base of the neck in response to the input acceleration measured at that point. A redundant photographic data system is being used for validation. Preliminary results are presented. Author (TAB)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N70-10002*# Minnesota Univ., Minneapolis.
APPLICATIONS OF THE MINNESOTA IMPEDANCE CARDIOGRAPH
William G. Kubicek *In its* Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and other Cardiac Parameters 30 Jun. 1969 p 1–15 (See N70-10001 01-04)
Avail: CFSTI CSCL 06B

A four-electrode configuration for measuring cardiac output or other cardiovascular or pulmonary functions is described, and some applications of the instrument are suggested. The method for calculating stroke volume and cardiac output is treated in detail. Mention is made of the use of the impedance cardiograph as a visual monitor of the heart's mechanical action and in studies of circulation in the legs. A.C.R.

N70-10003*# Cape Town Univ. (South Africa). Surgical Research Labs.
THE USE OF THE MINNESOTA IMPEDENCE CARDIOGRAPH IN THE CHRONIC MONITORING OF CARDIAC TRANSPLANT PATIENTS AT THE GROOTE SCHUUR HOSPITAL, CAPE TOWN
David A. Boonzaier and C. N. Barnard *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and other Cardiac Parameters 30 Jun. 1969 p 16–42 (See N70-10001 01-04)
Avail: CFSTI CSCL 06B

The utilization of the impedance cardiograph in chronic monitoring of two cardiac transplant patients is described. The instrument was evaluated for its reliability as a noninvasive method of assessing output and other cardiac parameters, not only for use in clinical medicine but also for possible aerospace medicine applications. Over an eleven month period, the cardiograph was used in chronic monitoring, with a close watch simultaneously kept on clinical, biochemical, serological, ECG and ZCG parameters. The objective was to establish baselines for cardiac transplants and to give early warning of rejection should it ensue. Acute rejection was suspected and treated on several occasions, but since none progressed to complete rejection the diagnosis was never conclusively confirmed. On the basis of the obtained results, however, it was concluded that the instrument, together with ECG and other tests, is a valuable adjunct to diagnosis and an index of the efficiency of treatment and return of the transplant patient to normality. A.C.R.

N70-10005*# Colorado Univ., Denver. Depts. of Surgery.
TRANSTHORACIC ELECTRICAL IMPEDANCE AS A CLINICAL GUIDE TO INTRATHORACIC FLUID VOLUMES
Marvin Pomerantz and Ben Eiseman *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and other Cardiac Parameters 30 Jun. 1969 p 67–77 refs (See N70-10001 01-04)
(Grant N00014-69-A0078-0001)
Avail: CFSTI CSCL 06B

Preliminary clinical data concerning change in transthoracic impedance, as it reflects intrathoracic fluid accumulation, are presented, and the experimental technique is described in detail. Implicit in the system is the use of impedance cardiography as a guide to the early detection of pulmonary edema and insufficiency. Twelve patients with a variety of clinical conditions, either producing or suspected of producing increased intrathoracic fluid volumes, were studied. The data indicate the impedance (Zo) changes are an accurate reflection of changes in such volumes. A.C.R.

N70-10007*# Harvard Univ., Boston, Mass. Dept. of Surgery.
PULMONARY EXTRAVASCULAR WATER VOLUME: POTENTIAL FOR MEASUREMENT BY THE MINNESOTA IMPEDANCE CARDIOGRAPH
Joseph M. Van de Water, Jaen-Min Sheh, Nicholas E. O'Conner, and Francis D. Moore *In* Minn. Univ. Develop. and Evaluation of an Impedance Cardiographic System to Meas. Cardiac Output and other Cardiac Parameters 30 Jun. 1969 p 97–102 refs (See N70-10001)
Avail: CFSTI CSCL 06B

Initial studies on the detection and quantification of early pulmonary edema are briefly reported. The pulmonary extravascular water volume is measured in critically ill and cardiac surgery patients. When normalized in terms of the patients's total lung capacity, the water volume was found to correlate well with the clinical course, X-ray changes, and the pulmonary shunt. Author

N70-10037+ National Lending Library for Science and Technology, Boston Spa (England).
A COMMON STRUCTURE FOR THE ACTIVITY OF OPERATORS AND SOME CONDITIONS FOR ITS FORMATION [OBSHCHAYA STRUKTURA DEYATEL'NOSTI OPERATOROV I NEKOTORYYE USLOVIYA EE FORMIROVANIYA]
E. A. Mileryan et al Jul. 1969 30 p refs Transl. into ENGLISH from Vopr. Psikhologii (Moscow), no. 4, 1966 p 74–86
(NLL-RTS-5180) Avail: Natl. Lending Library, Boston Spa, Engl.: 30s

Psychological studies of an operator's duties are reviewed to emphasize that the primary component in the activity structure of such workers is tracking the course of events and closely watching the general behavior and condition of the systems under their control. Based on these data, an experimental installation consisting of two control desks for the subject and the experimenter was devised to study the peculiar psychological implications in the formation of such operators' skills as have a common significance and are essential in work at a remote control desk. The number of repetitions required for acquisition of reflexes and capacities show considerable individual differences in the ability of subjects to master the work of an operator. A psychological selection program is recommended for choosing secondary school matriculants as candidates for professional training. M.G.J.

N70-10044*# Northrop Corp., Van Nuys, Calif. Electronics Div.
BIOMEDICAL RECORDING SYSTEMS Final Report
Aug. 1969 31 p
(Contract NAS9-7856)
(NASA-CR-101978; NORT-68-480) Avail: CFSTI CSCL 06B

The hardware definition, development, fabrication, and test of the recording system are described. The system is designed for use during portions of preflight and postflight medical examinations of flight crew personnel on Apollo missions. To give the system flexibility, it is packaged in three suitcases that also serve as shipping containers when closed. The system consists of signal conditioners, visual indicators, magnetic and strip-chart recorders, and auxiliary system parts. Author

N70-10123# Joint Publications Research Service, Washington, D.C.
ALL-UNION SYMPOSIUM ON SYSTEMS RESEARCH
M. D. Akhundov et al 27 Oct. 1969 6 p Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 8, 1969 p 158–161 Held at Moscow, Jan. 1969
(JPRS-49130) Avail: CFSTI

Summaries of papers on the methodology of systems research are given. The significance of the general ideas of cybernetics, the problem of optimization of systems, and the rational description of systems was emphasized. A critical assessment of the speaker's conclusion accompanies brief discussions on programmed control of the national economy, the general games concept in systems research, the application of the heuristic approach, Markov random processes, the planning of systems, and the dynamic theory of systems. M.H.E.

N70-10177# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
ANALYSIS AND PHYSIOLOGICAL EVALUATION OF TECHNICALLY ATTAINABLE FLASH FORMS OF TRAFFIC SIGNALS WITH A POINT LIGHT SOURCE [ANALYSE UND PHYSIOLOGISCHE BEWERTUNG TECHNISCH ERZIELBARER BLINKFORMEN VON VERKEHRSSIGNALEN MIT PUNKTFOERMIGER LICHTQUELLE]
Kurt W. Uhl (Ph.D. Thesis) 1969 164 p refs In GERMAN
Avail: CFSTI

The known methods for the physiological evaluation of flashing lights in signal technology were applied to either certain conditions of observation (threshold determination) or to special signals (beacons). A new method for the evaluation of flashing lights is demonstrated which takes into account the environmental conditions and the intensity of the signal light. The threshold coefficient and the flashing coefficients were defined for this purpose. Additional steps and the required instrumentation are described for changing the flash form. Three different technically attainable flash forms are compared: the exact signal, the flash signal, and the multi-filament signal. These signals are optimized for various operational requirements, taking into account the type of apparatus and energy costs. For the specific example of railroad crossings, it is shown that the exact flash is the best signal form. Transl. by K.W.

N70-10369# Stanford Univ., Calif. Dept. of Electrical Engineering.
SELF REPRODUCING AUTOMATA: SOME IMPLICATIONS FOR THEORETICAL BIOLOGY
Michael A. Arbib Jul. 1969 45 p refs
(Contract Nonr-225(87); Grant AF-AFOSR-1198-67)
(AD-692529; AFOSR-69-2053) Avail: CFSTI CSCL 6/4

The basic concepts of models of self-reproducing automata are reviewed that share with living systems the property of repetitive production of ordered heterogeneity. The models are also shown to require separate descriptions of the system and the active portion of the system, as there is a distinction between the genotype (a set of instructions) and the phenotype (their functioning embodiment). Reasons are discussed as to why this condition may be necessary in more complex organisms. An explanation is given of a way in which an array model of an automaton can exhibit some of the embryonic properties of resistance to damage to augment the automaton-theoretic approach that provides no insight into reaction to damage. Characteristics of an automaton are considered for evolution. The model must contain internal programs that are themselves modifiable programs, in contrast to models in which each module contains the whole program of the organism, differentiation represented only by activation of different portions of the program. An understanding is needed of how to apply coding theory to the problem of endurance and multiplication in the presence of noise. It is suggested that apparent disorder in complex living systems may be due to adaptation. TAB

N70-10523# Dynatech Corp., Cambridge, Mass.
AN EXPERIMENTAL INVESTIGATION AND SYSTEM DESIGN FOR HUMIDITY AND CARBON DIOXIDE LEVEL CONTROL USING THERMAL RADIATION
John S. Maulbetsch Wright-Patterson AFB, Ohio AFML Apr. 1969 114 p refs
(Contract F33615-67-C-1587)
(AD-692169; AMRL-TR-68-174) Avail: CFSTI CSCL 6/11

An experimental investigation was carried out to verify the feasibility of controlling carbon dioxide levels in space cabin atmospheres by freeze-out techniques using thermal radiation as the only mode of heat rejection. A one-tenth scale system was constructed with the primary aim of gaining understanding of the CO2 precipitation mechanism and determining the operating characteristics of a precipitator plate. Both quantitative measurements and visual observation of the frost formation were made. The geometric characteristics of the precipitator channel were found to be not critical. Uniform frost layer formation could be obtained and premature channel plugging was not a problem. Typical precipitator plate effectivenesses of 0.75 - 0.85 were easily obtainable. Simultaneous CO2 sublimation was achievable at a controllable rate System stability was easily achieved. Solid CO2 carryover in both the precipitating and sublimating streams is a real possibility and preventive measures must be taken in the final design of the system. Based on these results, a complete test system was designed to handle the water vapor and carbon dioxide loads in a one-man, manned space enclosure. The system, with a total weight of 51.2

lb, is a two-loop configuration where one loop maintains humidity control and the other removes the generated carbon dioxide and returns all of the accompanying water vapor to the cabin. The system will operate indefinitely with no operator intervention, is operable in zero-gravity, and is of low weight, volume, and power.
Author (TAB)

N70-10677# Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Bad Godesberg (West Germany). Inst. für Flugmedizin.

INDICES OF FUNCTIONAL CAPACITY DURING PHYSICAL EXERCISE UNDER OXYGEN DEFICIENCY [DAS VERHALTEN VON LEISTUNGSKRITERIEN BEI KOERPERLICHER ARBEIT IM SAUERSTOFFMANGEL]

J. Uthoff (Ph.D. Thesis-Bonn Univ.) Jul. 1969 61 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-41) Avail: CFSTI

In 12 highly trained athletes the functional capacity under acute hypoxic conditions was examined with a bicycle ergometer at 578 mm Hg by gradually increasing the physical load. Pulse rate, oxygen pulse, oxygen intake and respiratory quotient served as indices of the functional capacity. When at rest, heart rate (+ 5.7 beats/min), oxygen pulse (−0.7 ml/beat) and respiratory quotient (+ 0.04) exhibited significant differences, while the other indices did not. During submaximal work highly significant differences showed up for all criteria except oxygen intake. On the other hand, the maximum values were identical only for heart rates. The expiration volume differed by + 10%, oxygen intake by −10%, oxygen pulse by −9%, respiratory quotient by + 6.5% and the inhale/exhale ratio by + 20%.
Author (ESRO)

N70-10761# Ohio State Univ., Columbus. Human Performance Center.

CONCERNING THE SIMULATION OF DIAGNOSTIC SYSTEMS WHICH PROCESS COMPLEX PROBABILISTIC EVIDENCE SETS Final Report, Aug. 1965 – Aug. 1966

David A. Schum Apr. 1969 44 p refs
(Contract AF 33(615)-2248)
(AD-691238; AMRL-TR-69-10) Avail: CFSTI CSCL 5/8

The report provides a theoretical and methodological background for a series of experiments being performed on diagnostic systems. The basic methodology underlying current simulation of diagnostic environments has been changed considerably to achieve the level of task complexity required for the study of certain problems judged to be of significance in real diagnostic systems. In the current series of experiments, the Bayesian evidence aggregation or PIP procedure will be compared with the procedure of having men make direct estimates of posterior probabilities from data. The latter procedure will be referred to as POP. The major reason for continuing the comparison between these two procedures is that results from the POP procedure will provide important additional base-line data in the evaluation of the PIP procedure. Although one can now expect PIP to be generally superior to POP, it will often be of considerable interest to determine how much superior PIP is in various experimental circumstances. The current simulation methodology allows for several theoretical standards for evaluating the accuracy of posterior probabilities produced by the PIP and POP procedures.
Author (TAB)

N70-10907*# Analytical Mechanics Associates, Inc., Palo Alto, Calif.

THE CALCULATION OF MOTION DRIVE SIGNALS FOR PILOTED FLIGHT SIMULATORS

Stanley F. Schmidt and Bjorn Conrad Oct. 1969 77 p refs
(Contract NAS2-4869)
(NASA-CR-73375; Rept-69-17) Avail: CFSTI CSCL 05I

Methods of using computed motion values to obtain signals representing similar motions compatible with the cab's limitations in flight simulators are investigated with the objective of improving the techniques in designing the washout logic circuits. The overall motion simulation problem and some fundamental assumptions about pilot sensed motion are reviewed. Difficulties imposed by motion constraints inherent in motion simulators and traditional washout circuits are described. New concepts are developed incorporating feedback control which provides coordinated drive signals for rotational and translational motions.
F.O.S.

N70-11000# Georgia Inst. of Tech., Atlanta. School of Information Science.

INDEXING CONSISTENCY AND QUALITY

Pranas Zunde and Margaret E. Dexter 1969 42 p refs
(Grant NSF GN-655)
(PB-185400; GITIS-69-08) Avail: CFSTI CSCL 05B

A measure of indexing consistency is developed based on the concept of fuzzy sets. It assigns a higher consistency value if indexers agree on the more important terms than if they agree on less important terms. Measures of the quality of an indexer's work and exhaustivity of indexing are also proposed. Experimental data on indexing consistency are presented for certain categories of indexers, and consistency, quality, and exhaustivity values are compared and analyzed. The analysis of indexing exhaustivity leads to the conclusion that the increase of information as a result of group indexing is a process analogous to the Bradford's law of information scattering, Lotka's law of scientific productivity and Zipf's law of vocabulary distribution.
Author (USGRDR)

N70-11095# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.

FLIGHT EVALUATION OF THE EFFECT OF APPROACH SPEED ON PILOT PERFORMANCE Final Report, Oct. 1967 – Apr. 1969

Edward Seckel and George Miller Apr. 1969 48 p refs
(Contract Nonr-1858(50); Grant NSF GP-579)
(AD-691290; Rept-831) Avail: CFSTI CSCL 1/2

Simulated carrier approaches were flown by Navy carrier pilots in a variable stability airplane. The approaches were visual, in daylight, at three closure speeds. Moderate natural turbulence and the carrier turbulence wake were simulated. The longitudinal and lateral-directional dynamics were maintained constant for the three approach speeds with the variable stability airplane. Measures of pilot performance in terms of altitude at the simulated ramp and touchdown distance from the ramp were obtained for the three approach speeds. These data were compared with similar performance measures of carrier approaches of combat experienced pilots.
Author (TAB)

N70-11150# Massachusetts Inst. of Tech., Cambridge. Dept. of Electrical Engineering.

COMPUTER RECOGNITION OF THREE-DIMENSIONAL OBJECTS IN A VISUAL SCENE

Adolfo Guzman-Arenas (Ph.D. Thesis) Dec. 1968 290 p refs
(Contract Nonr-4102(01))
(AD-692200; MAC-TR-59) Avail: CFSTI CSCL 9/2

Methods are presented: (1) to partition or decompose a visual scene into the bodies forming it; (2) to position these bodies in three-dimensional space, by combining two scenes that make a stereoscopic pair; (3) to find the regions or zones of a visual scene that belong to its background; (4) to carry out the isolation of objects in (1) when the input has inaccuracies. Running computer programs implement the methods, and many examples illustrate their behavior. The input is a two-dimensional line-drawing of the scene, assumed to contain three-dimensional bodies possessing flat faces (polyhedra); some of them may be partially occluded. Suggestions are made for extending the work to curved objects. Some comparisons are made with human visual perception. The

main conclusion is that it is possible to separate a picture or scene into the constituent objects exclusively on the basis of monocular geometric properties (on the basis of pure form); in fact, successful methods are shown. Author (TAB)

N70-11287# Georgia Inst. of Tech., Atlanta. School of Information Science.
A GENERAL INFORMATION SYSTEM FOR LEARNING
Vladimir Slamecka 1969 24 p refs
(Grant NSF GN-655)
(PB-185405; GITIS-69-02) Avail: CFSTI CSCL 05I

The paper is concerned with the application of information engineering approaches to the design of large general purpose educational systems. The subject is developed through a brief discussion of the following topics: design objectives of future educational systems; an information processing model of the educational process; a basic configuration of a general purpose information system for education; and the state of art of information technology relevant to such a system. The paper concludes with a description of one educational system under study. Author (USGRDR)

N70-11309# Navy Experimental Diving Unit, Washington, D.C.
JOINT U.S. NAVY-DUKE UNIVERSITY 1000 FOOT SATURATION DIVE Final Report
James K. Summitt, James S. Kelley, Jerry M. Herron, and Herbert A. Saltzman 14 Apr. 1969 53 p refs
(AD-692424; NEDU-RR-3-69) Avail: CFSTI CSCL 6/11

Five experimental subjects were exposed to a simulated depth of 1000 feet of seawater in the Duke University hyperbaric chamber complex. The compression phase was completed over a 24 hour and 22 minute period, an average descent rate of 1.5 minutes per foot. The subjects remained at the 1000 foot depth for 77 hours and 30 minutes. This was followed by 284 hours of decompression, a rate of approximately 15 minutes per foot with four hour stops at ten staging depths. An extensive series of biomedical, diving equipment and human performance tests was conducted during each phase of the dive sequence. Oxygen and carbon dioxide levels were very accurately controlled within safe limits, though the oxygen was manipulated periodically to meet the requirements of specific biomedical experiments. These observations indicate that divers can perform well under these conditions if life support systems maintain a level of support equivalent to that at the surface. Author (TAB)

N70-11310# Navy Experimental Diving Unit, Washington, D.C.
DIVER EQUIPMENT TESTS PERFORMED DURING THE JOINT US NAVY/DUKE UNIVERSITY 1000 FOOT SATURATION DIVE Final Report
John V. Harter 15 Apr. 1969 33 p
(AD-692423; NEDU-RR-2-69) Avail: CFSTI CSCL 6/11

A series of diving equipment tests were performed at depths of 1000 and 850 feet during the joint Duke University/Navy 1000 feet saturation dive at Durham, North Carolina. Description of tests performed and results thereof are presented for documentation purposes. Recommendations for modifications and further testing are presented. Author (TAB)

N70-11312# Philco-Ford Corp., Palo Alto, Calif. Western Development Labs.
AN INVESTIGATION OF THE RELATIONSHIP BETWEEN OPERATOR PERFORMANCE AND OPERATOR PANEL LAYOUT FOR CONTINUOUS TASKS Final Report, 15 Jan. 1968 – 15 Sep. 1968
R. L. Fowler, W. E. Williams, M. G. Fowler, and D. D. Young Dec. 1968 78 p refs
(Contract AF 33(615)-3439)
(AD-692126; WDL-TR-3586; AMRL-TR-68-170) Avail: CFSTI CSCL 5/8

The study evaluated four principles of control panel layout: sequence of use, functional grouping, optimum location by frequency of use, and optimum location by importance. The four principles were evaluated by experiments which included stress conditions and three levels of application of each of the arrangement principles. Author (TAB)

N70-11343 National Lending Library for Science and Technology, Boston Spa (England).
SIMULATING THE PROCESSING OF DATA ON THE FREQUENCY AND INTENSITY OF SOUND SIGNALS IN THE AUDITORY SYSTEM [MODELIROVANIE PROTSESSA PERERABOTKI INFORMATSII O CHASTOTE I INTENSIVNOSTI ZVUKOVOGO SIGNALA V SLUKHOVOI SISTEMA]
I. A. Lyubinskii et al Jun. 1969 17 p refs Transl. into ENGLISH from Probl. Fiziol. Akustiki Inst. (USSR), no. 6, 1966 p 209 – 221
(NLL-RTS-5078) Avail: Natl. Lending Library, Boston Spa, Engl.: 32s 6d

Developed is a structural model for data processing in the neuron network of a sonic analyzer situated between the organ of Corti and the projection zone in the auditory cortex. Reactions of the model to monotonic sound signals of long duration are defined in terms of intensity and frequency. An attempt is made to explain transition phenomena which can be observed in electrophysiological investigations. The permissibility of conversions in models of neuron layers is determined by the reliability of relevant conversions in elements of the neuron type. G.G.

N70-11358*# Southwest Research Inst., San Antonio, Tex.
SOUTHWEST RESEARCH INSTITUTE ASSISTANCE TO NASA IN BIOMEDICAL AREAS OF THE TECHNOLOGY UTILIZATION PROGRAM Quarterly Progress Report, 1 May – 31 Jul. 1969
Louis S. Berger, Betty J. Wall, and W. R. Brian Caruth 15 Aug. 1969 85 p refs
(Contract NASw-1867; SwRI Proj. 13-2538)
(NASA-CR-106641; QPR-2) Avail: CFSTI CSCL 05B

Introduction and dissemination of NASA derived technologies to biomedical scientists at research institutions with subsequent transfer to medical practitioners is discussed and a general methodology for the solution of this technical transfer problem is found in the creation of biomedical application teams for the processing of proposals. During the period May through July, 1969, numerous medical problem statements were received by the teams and problem abstracts worked on are attached. They cover a wide range of activities from computer programs and systems for analyses of biomedical samples to instrumentation and measuring methods for electrical body signals, rate and depths of breathing, blood flow and composition, oxygen metabolism, etc. G.G.

N70-11386# Ohio State Univ., Columbus. Human Performance Center.
AIDED HUMAN PROCESSING OF INCONCLUSIVE EVIDENCE IN DIAGNOSTIC SYSTEMS: A SUMMARY OF EXPERIMENTAL EVALUATION Final Report, 1 Oct. 1965 – 1 Jun. 1966
David A. Schum, Jack F. Southard, and Louise F. Wombolt Wright-Patterson AFB, Ohio , USAF May 1969 69 p refs Prepared in cooperation with Rice Univ., Houston, Tex.
(Contract AF 33(615)-2248; Grant NSF-GU-1153)
(AD-691239; AMRL-TR-68-11) Avail: CFSTI CSCL 5/8

The report describes three experimental evaluations of a procedure for aiding men in combining probabilistic (inconclusive) information. The procedure is called Semi PIP (Probabilistic Information Processing). In the semi PIP procedures, a computer

relieves man of part of the task of combining probabilistic evidence. The experiments involved a simulated military threat-diagnosis task in which probabilistic data are used as a basis for deciding among alternative hypothesized threats. The Semi PIP was compared with an unaided procedure called POP (Posterior Probability), and both procedures compared with a mathematically ideal combination of evidence (Bayes theorem). It was found from the three experiments that: (1) overall, the difference between Semi PIP and POP performance was very slight; (2) POP was best when a small total amount of evidence accumulated very rapidly; and, (3) Semi PIP was slightly, though consistently, superior when the total amount of evidence to be evaluated was large, when the total diagnostic impact in a set of evidence was large, or when both these conditions prevailed. Specific implications of the results for diagnostic system design and for research on basic human inference processes are summarized. Author (TAB)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N70-10036 Stanford Univ., Calif.
ENZYMIC AND NON-ENZYMIC CYCLIZATIONS OF TERPENOID TERMINAL EPOXIDES
Ronn George Nadeau (Ph.D. Thesis) 1968 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-8231

Stannic chloride catalyzed cyclizations of terpene terminal epoxides and the enzymic (2,3-oxidosqualene-lanosterol cyclase) cyclization of three squalene terminal epoxide modifications are investigated. The stannic chloride catalyzed cyclization of geranylgeranyl acetate-terminal-epoxide gave, among other products, about 30% of a chromatographically purified hydroxyacetate fraction. Further refinement of this material led to the isolation and identification of a tricyclic iso-agathic acid type structure. Experiments dealing with the stannic chloride catalyzed cyclization of squalene terminal epoxide provided evidence for the structure of two previously unidentified products of this reaction. Epoxides were produced in good yield from radioactive aldehyde by sulfur ylide reactions using dimethyl sulfonium methylide and diethyl sulfonium ethylide. Dissert. Abstr.

N70-10050 Rutgers Univ., New Brunswick, N.J.
PART 1: MECHANISTIC STUDIES OF THE PERKOW REACTION. PART 2: A STUDY OF THE GEOMETRIC STABILITIES OF HETEROATOM-CONTAINING CATIONS
Frank A. Wagner, Jr. (Ph.D. Thesis) 1968 161 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-7592

Under the conditions of the Perkow reaction cyclic phosphites were allowed to react with chloral and trichloro acetophenone, and the relative rates were compared with those for trimethyl phosphite (VIII). The order of decreasing reactivity was found to be I > VIII > II > III > IV > V > VI > VII. Second-order rate plots were obtained for both carbonyl reagents and representative acyclic and cyclic phosphites in two solvent systems. The alkylations of cis- or trans-methyl cinnamates with dimethoxy- or diethoxycarbonium hexachloroantimonates led to the formation of *cisoid* and *transoid* ions, respectively. The alkylations were shown to occur exclusively on the carbonyl oxygen atom, and delocalization of the positive charge into the allylic systems was substantiated by proton nmr analysis. The alkylations of methyl senecioate, mesityl oxide, and senecionitrile with dimethoxycarbonium hexachloroantimonate also were shown to proceed with exclusive alkylation of the heteroatoms, by nmr analysis and hydrolysis of the cations. Dissert. Abstr.

N70-10051 Delaware Univ., Newark.
A KINETIC INVESTIGATION OF CHROMIC ACID OXIDATION
Stanley Lawrence Alekman (Ph.D. Thesis) 1968 177 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-15523

The rate constants for chromic acid oxidation were determined for the following pinacols: 1,1'-dihydroxy-1,1'-dicyclopentyl, 1,1'-dihydroxy-1,1'-dicyclohexyl, perfluoropinacol, cis- and trans-9,10-dihydroxy-9,10-dimethyl-9,10-dihydrophenanthrene, cis- and trans-9,10-diethyl-9,10-dihydroxy-9,10-dihydrophenanthrene, cis- and trans-7,8-diethyl-7,8-dihydroxyacenaphthene; and for the following secondary alcohols: 2,2',4,4',6,6'-hexamethyldiphenylcarbinol, di-t-butylcarbinol, di(perfluoroisopropyl)carbinol, and 1,1,1,3,3,3-hexafluoro-2-propanol. The rate studies were conducted in acetic acid and 1,4-dioxane solutions. Kinetic activation parameters were determined for the nonfluorinated alcohols. Solvent isotope effects were measured. Acidity constants for chromic acid were determined spectrophotometrically as a function of solvent composition.
Dissert. Abstr.

N70-10054 Pennsylvania Univ., Philadelphia.
THE MECHANISM OF THE ANODIC OXIDATION OF HYDROCARBONS
Glenn Earl Stoner (Ph.D. Thesis) 1968 309 p
Avail: Univ. Microfilms: HC $13.95/Microfilm $4.00 Order No. 69-5672

The anodic oxidation of ethylene at platinum electrodes in 1 N H_2SO_4 was studied by the potential sweep method. At sweep rates below 0.001 v/sec, the data were consistent with steady-state measurements. For faster sweep rates, the peak potential, the peak current density, and the apparent Tafel slope all varied with sweep rate in a manner consistent with an irreversible diffusion-controlled reaction. Steady-state measurements were made for the anodic oxidation of ethylene and four saturated hydrocarbons in 85% H_3PO_4 at platinized platinum electrodes. For ethylene, the temperature-dependent Tafel slope and reaction order with respect to ethylene and water indicate potential-dependent inhibition by phosphoric acid at lower temperatures (80 -130 C) and rate-determining combination between adsorbed CH_2 and OH radicals. Dissert. Abstr.

N70-10055 Yale Univ., New Haven, Conn.
KINETICS OF HOMOGENEOUSLY CATALYZED REACTIONS BETWEEN GASES AND LIQUIDS WITH AND WITHOUT DIFFUSIONAL EFFECTS
Bernard Silberstein (Ph.D. Thesis) 1968 201 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 69-8435

The substitution reaction between chlorine and benzene, catalyzed with stannic chloride, was studied under conditions where the effects of mass transfer are completely absent, and a reaction rate expression is proposed which takes into account the equilibrium formation of a molecular complex between the reactants. The experimental data obtained in this investigation confirm the superiority of this expression over the simple second order kinetics reported by previous workers. The same system was studied under heterogeneous conditions (two phase system), and a mathematical model has been developed which successfully describes the behavior of the mass transport-chemical reaction process. Under the experimental conditions studied, no effect of diffusion on selectivity

was observed when the chlorination was continued to the stage where dichlorobenzenes are formed. By simultaneous solution of the steady state diffusion equation and the Lewis–Whitman laminar film theory of diffusion it was possible to evaluate both the mass transfer coefficient and the specific interfacial area for transport of material between the phases. Dissert. Abstr.

N70-10056 Northwestern Univ., Evanston, Ill.
CHEMICAL AND RADIOTRACER DIFFUSION IN MnO SUB (1 PLUS x)
James Brian Price, Jr. (Ph.D. Thesis) 1968 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-6979

From the tarnish rate theory and point defect models equations were derived which interrelate the fundamental diffusivities of an oxide of the type MeO sub (1+x). It was shown that the thermodynamic factor may be simply expressed as a function of the deviation from stoichiometry and that the mole fractions of defects and lattice ions also may be expressed in terms of the deviation from stoichiometry. These formulations were tested on published data of chemical and tracer diffusion in wüstite, and appropriate experiments were conducted upon manganous oxide so that the equations could be applied to manganous oxide too. A format for testing the boundary conditions for chemical diffusion data is presented. With a combination of several simple experiments and a general solution of Fick's second law it was shown that the gas-solid interface may not always equilibrate instantaneously, and that the experimental results must be tested in order to distinguish between diffusion controlled kinetics and diffusion-dissociation kinetics. Data also were generated to help clarify the nature of the point defects in n-type manganous oxide. Dissert. Abstr.

N70-10063# Atomics International, Canoga Park, Calif.
DETERMINATION OF TRACE ELEMENTS IN SODIUM
B. G. Johnson and M. S. Maseda 15 Jun. 1969 34 p refs
(Contract AT(04-3)-701)
(AI-AEC-12799) Avail: CFSTI

Detailed analytical procedures for determination of trace elements (Bi, Fe, Cr, Mo, Ni, Nb, C, and O) in sodium are presented. The procedures are suitable for analysis of sodium samples containing as low as 2 micrograms of the metal or nonmetal sought. A number of analytical techniques, including spectrophotometry, flame spectrophotometry, atomic absorption, and gas chromatography, are utilized in the determinations. The analytical procedures for determination of the various solute materials are, in most cases, adaptations of published methods. The published procedures are adapted to accommodate the low levels of solute concentration and the interferences contributed by the collector materials. Author (NSA)

N70-10068# Institute of Technology, Helsinki (Finland).
ON THE PRECIPITATION OF AMMONIUM POLYVANADATE
Ulla-Maija Levanto (Ph.D. Thesis) Finnish Acad. of Tech. Sci. 1969 37 p refs
(PB-184631; APS-CH-82) Avail: CFSTI CSCL 07B

Comparatively few studies have been made on ammonium vanadates, especially ammonium polyvanadates, although they are important intermediates in the industrial production of vanadium pentoxide. The effects of crystallization conditions on the nature and properties of precipitated ammonium polyvanadates were investigated on the laboratory scale. The crystal structures of the precipitates were determined by X-ray diffractiometry. The purity of an ammonium polyvanadate precipitate depends on the composition of the initial solution, the pH of the solution during the precipitation, and the reaction time. It was found that ammonium polyvanadate contains vanadium cations and that its formula is (NH4)4(VO2)2V10O28. Author (USGRDR)

N70-10069 Iowa Univ., Iowa City.
THE DICHLOROIDATE SALT OF THE TETRA-P-ANISYLETHYLENE DICATION AND THE DICHLORIDE COMPLEX OF BIS-(p-CHLOROPHENYL) SULFIDE: TWO CRYSTAL STRUCTURES
Thomas David Simpson (Ph.D. Thesis) 1968 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-8811

The crystal structure of the dichloroiodate(I) salt of the tetra-p-anisylethylene dication was determined from single crystal X-ray diffraction data. An X-ray diffraction study at low temperature (approximately 143 K.) of the unstable complex of bis-p-chlorophenyl sulfide was made to determine the nature of the bonding involved. A nearly trigonal bipyramid configuration was found for the sulfur atom with the complexing chlorine atoms located in the axial positions. The complex examined was formed by the chlorination of a solution of the organic sulfide. Film data were gathered at low temperature using Weissenberg procedures and Buerger precession techniques. The intensities were estimated visually. A 3-dimensional Patterson map was used to locate the sulfur and four chlorine atoms. The remaining organic portion was uncovered using electron density maps. A full matrix least squares treatment led to a weighted residual factor of 0.0875 and a conventional R factor of 0.1151. Dissert. Abstr.

N70-10070 New York Univ., N.Y. School of Engineering and Science.
THE EFFECT OF MIXING ON PRODUCT DISTRIBUTION FOR A HOMOGENEOUS, LIQUID-PHASE, SECOND-ORDER, COMPETITIVE CONSECUTIVE REACTION IN A SEMI-BATCH REACTOR
Edward Lober Paul (Ph.D. Thesis) 1968 175 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-7710

The effect of mixing on the homogeneous, liquid-phase, second order, competitive-consecutive reaction of iodine (B) with L-tyrosine (A) to form 3-iodo-L-tyrosine (R) and 3,5-diiodo-L-tyrosine (S) was experimentally determined for the turbine speed and diameter, vessel diameter, feed inlet location, addition rate, and distribution, baffled and unbaffled conditions, reaction temperature, initial concentration of A, and reaction mixture kinematic viscosity. The local fluctuating velocity at the point of feed introduction was found to permit correlation of the mixing variables and prediction of mixing requirements for the maintenance of equivalent yields of R on scale-up. The regions of excess B concentration can be related to the concept of partial segregation, intermediate between macro- and micro-mixing. A model is developed to predict product distribution as a function of mixing conditions for this reaction system. The model suggests that consecutive reaction systems with pseudo first order rate constants greater than 0.5/sec. are subject to significant mixing effects. Dissert. Abstr.

N70-10071 Johns Hopkins Univ., Baltimore, Md.
HIGH TEMPERATURE KINETICS OF BROMINE ATOM RECOMBINATION
Osamu Horie (Ph.D. Thesis) 1968 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-8677

The rate of the recombination reaction of bromine atoms for HBr as third body was experimentally determined in the hot flame gases of a steady, laminar hydrogen-bromine flame. A novel Br atom detector was developed and combined with the microprobe sampling technique for measuring the Br atom profile. The detector consisted of a pair of nickel wire coils which formed two

adjacent arms of a Wheatstone bridge. A simple theory of Br atom conservation in the constant temperature hot flame gases was formulated in order to calculate the rate coefficient of the recombination reaction from the experimentally determined Br atom concentration profile in the hot flame gases. The operating conditions of the flame were with an initial mixture of 45.6% Br^2 a burner pressure of 0.118 atm, and a total mass flow rate of 0.182 g/sec. At the flame temperature of 1417K, the value for rate coefficient was obtained, and it agrees with existing shock tube data within the experimental error. Dissert. Abstr.

N70-10072 Stanford Univ., Calif.
VELOCITY MEASUREMENTS IN DILUTE POLYMER SOLUTIONS
Carl Alan Friehe (Ph.D. Thesis) 1968 199 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-9181

The experimental studies presented were motivated by the desire to obtain an understanding of the phenomenon of drag reduction, whereby the addition of small amounts of soluble high molecular weight polymers to liquid systems in turbulent shear flows greatly decreases the drag force or pressure drop. The water soluble polymer chosen was an ionic polyacrylamide which exhibits drag reduction in pipes, and the concentration range covered was from 10 to 300 parts per million. The use of Pitot-static tubes to measure the free-stream velocity was verified by an independent method using electrochemically generated small hydrogen bubble tracers. The heat transfer characteristics of cylindrical and conical hot-film probes were obtained in water and the polymer solutions to determine the validity of inferring velocity measurements from the measured heat transfer. The results obtained in the studies outlined indicated that, for most of the problems, the addition of small amounts of the polymer produced significant differences in the hydrodynamic properties of the flows. Dissert. Abstr.

N70-10076# Oak Ridge National Lab., Tenn. Office of Language Services.
RELATIVE STELLAR ABUNDANCE AND ORIGIN OF THE CHEMICAL ELEMENTS
A. Unsoeld [1969] 12 p refs Transl. into ENGLISH from Z. Physik. (Berlin), no. 202, 1967 p 13-21
(ORNL-TR-1833) Avail: CFSTI

The hypothesis that the heavier elements are formed in connection with the origin and collapse of stars runs into many difficulties. The hypothesis is advanced, therefore, that the heavy elements were formed principally in a powerful explosion in the core of the Milky Way approximately 7×10 to the 9th power years ago; this assumption is compatible with present knowledge of cosmic time intervals. This indicates that the relative frequency of all heavy elements in stars of extremely small, normal, and twice supernormal metal frequency are the same within the analysis accuracy. The empirical rule found by Suess on the frequency distribution must be accessible within the framework of the new hypothesis before an explanation is possible. The frequency ratio He:H is discussed in detail. The production of heavy elements in individual stars and supernovae is considered. Empirical results do not indicate that such processes have significantly influenced the frequency distribution in the majority of stars or in interstellar matter. Author (NSA)

N70-10082# Maryland Univ., College Park. Physics and Astronomy Dept.
SELECTED WATER VAPOR LINE PARAMETER MEASUREMENTS WITH ACCURATE ABSORBER THICKNESS DETERMINATIONS
Bernard Fridovich (Ph.D. Thesis) Apr. 1969 178 p refs
(PB-184347; TR-979) Avail: CFSTI CSCL 07D

Measurements have been made on four lines in the vibration-rotation and ten lines in the pure rotation region of the water vapor spectrum to determine the individual line intensities and half-widths. The major effort of the experimental procedure has been the precise determination of absorber thickness. The technique used was to continuously circulate the sample gas through a hygrometer and measure its dewpoint while the sample was being scanned. Detailed accounts are given of the apparatus used, the calibrations performed, the measurements made and the methods of data reduction. The theoretical equations have been brought to a form suitable for computation. Author (USGRDR)

N70-10083# Kansas Univ., Lawrence. Chemistry Dept.
HIGH TEMPERATURE MASS SPECTROMETRY AND THE THERMODYNAMICS OF THE TITANIUM OXIDES
Paul W. Gilles 30 Apr. 1969 25 p refs
(Contract AT(11-1)-1140)
(PB-184305; COO-1140-180) Avail: CFSTI CSCL 07D

Among the many methods suitable for the establishment of thermodynamic properties of chemical substances, vaporization equilibrium measurements and mass spectrometry are especially well suited for high temperature metal-oxygen systems. The principles, procedures, limitations, and developments associated with these two methods are described. Thermodynamic properties for a binary system such as the titanium-oxygen system in which important, stable gaseous molecules are known can be obtained from mass spectrometric measurements only if the thermodynamic properties of their gaseous molecules are known. Vaporization studies and mass spectrometric measurements leading to values for the dissociation energies of TiO(g) and TiO2(g) yield values in substantial disagreement with each other at the present time. The origin of this discrepancy and its resolution are discussed with reference to the thermodynamic properties of the condensed titanium oxides. Author (USGRDR)

N70-10085 Catholic Univ. of America, Washington, D.C.
A STUDY OF RELAXATION IN ELECTROLYTIC SOLUTIONS USING ULTRASONIC AND LASER LIGHT SCATTERING TECHNIQUES
Klaus Fritsch (Ph.D. Thesis) 1968 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-8871

Sound velocity and absorption measurements were made in $NiSO_4$, $CoSO_4$, $CuSO_4$, $ZnSO_4$, $Al_2(SO_4)_3$, $Nd_2(SO_4)_3$, $Gd(NO_3)_3$ as well as NaCl and NaBr. Measurements between 30 MHz and 900 MHz were carried out using a high frequency ultrasonic cell. A number of measurements were made between 6000 MHz and 7000 MHz using the technique of Brillouin laser light scattering. The laser light scattering experiments allowed the first direct measurements of the absorption of water in the presence of electrolyte ions. The results indicate that generally this solvent absorption is equal to the absorption of water. The ultrasonic measurements in a number of solutions showed the existence of a double relaxation in the frequency region between 30 MHz and 600 MHz where single relaxations had been reported previously. Together with the previously observed low frequency relaxation this brought the total number of observed relaxations in five solutions up to three thus giving added support to the Diebler-Eigen three step model of ion association. Dissert. Abstr.

N70-10087 City Univ. of New York.
SOME THEORETICAL PROBLEMS IN STATISTICAL THERMODYNAMICS OF MIXTURES
Anne-Marie Sapse (Ph.D. Thesis) 1969 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-7610

PART I: Thermodynamic perturbation theory is applied to a binary mixture of real fluids. The unperturbed case is that of hard cores of diameter sigma and the perturbing potential is an attractive square well of depth epsilon and width 0.5 sigma. Excess functions of isobaric, isothermic mixing and critical points are calculated for a

mixture of hard spheres and hard spheres with tails and for a mixture of points (ideal gas component) and hard spheres with attractive tails. All the hard sphere core are of the same diameter. In the former case, our model exhibits "gas-gas" equilibria. PART II: Phase-separation temperatures for solid isotopic mixtures are calculated taking into account first and second nearest neighbor interactions for simple cubic, body centered and face centered lattices. Dissert. Abstr.

N70-10088 Johns Hopkins Univ., Baltimore, Md.
SOME GENERAL RESULTS FOR NONREACTING BINARY MIXTURES OF FLUIDS
Michael Louis Doria (Ph.D. Thesis) 1968 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-8669

This paper represents an attempt to derive some general results for a non-reacting mixture of two fluids. To describe the mechanics and thermodynamics of such a mixture we adopt the same balance equations, entropy inequality, and constitutive theory as formulated by Müller. In part I, the restrictions imposed on the constitutive relations by the entropy inequality are examined. In particular, the most general forms for the free energy function and the entropy flux vector are obtained. Making use of these results, the equations of motion for the mixture are set forth. In part II the consequences of requiring that uniform rest states be stable. This leads to additional restrictions on the free energy function. Following this, the theory is reformulated such that the total pressure, rather than the total density, appears as an independent variable in the constitutive relations. The resulting equations of motion are useful for describing mixtures with constraints on the total density. Finally necessary and sufficient conditions for the existence of static solutions are obtained. Dissert. Abstr.

N70-10090 Cornell Univ., Ithaca, N.Y.
A RAMAN SPECTROSCOPIC STUDY OF METAL ION COORDINATION: CHLORIDE, BROMIDE, AND NITRATE COMPLEXES OF BISMUTH(3)
Richard Paul Oertel (Ph.D. Thesis) 1968 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-5773

Raman intensity measurements were made on aqueous solutions containing various ratios of chloride to bismuth. Structural considerations are presented for all of the complex bismuth halide species identified. Absolute Raman intensities were measured for the two aqueous hexa-halogeno species and bond orders were thereby calculated for the bismuth-halide bond. Raman spectra (160-1700/cm) were recorded for aqueous solutions containing various ratios of nitrate to bismuth and also for a $Bi(NO_3)_3 \cdot 5H_2O$ - KNO_3 melt. Infrared spectra (400-1800/cm) were obtained for several of the solutions and the hydrate melt. Raman intensity measurements indicate the existence of step-wise complexes containing one through four nitrates per bismuth. Finally, bismuth(III) solutions containing both chloride and nitrate were examined spectrally to assess the influence of one ligand on the other in mixed-ligand complexes. Dissert. Abstr.

N70-10092 Tennessee Univ., Knoxville.
ORGANOMETALLIC STUDIES. PART A: ORGANOALUMINUM COMPLEXES OF TERTIARY AMINES. PART B: QUANTITATIVE ANALYSIS OF ORGANOLITHIUM AND MAGNESIUM REAGENTS. PART C: ELECTRON TRANSFER REACTIONS OF ORGANOLITHIUM AND MAGNESIUM REAGENTS
Spencer Charles Watson (Ph.D. Thesis) 1968 161 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-7187

Lewis acid-base complexes of some representative trialkyl-, dialkylhydride- and alkylchloroaluminum compounds (acids), X_3Al, with mono- and a difunctional tertiary amine (bases) were studied by p.m.r. spectroscopy. The relative Lewis acidity of the aluminum reagent decreases in the following order: R sub n AlCl sub 3 -n L R sub 2 AlH L R sub 3 Al, as determined from the chemical shift of the protons on the alpha-carbons of the amines in the delta-complexes. Sedimentation equilibrium molecular weights of an equimolar mixture of F sub 2 and F sub 3 revealed formation of a complex which exhibited a pH dependent association-dissociation equilibrium between pH 4 and 6, in qualitative agreement with structural isomerization (N-F) known to occur in BPA in this pH range. Dissert. Abstr.

N70-10093 IIT Research Inst., Chicago, Ill.
QUANTUM CHEMISTRY OF THE LITHIUM HYDRIDE DIMER
John Raymond Tyndall (Ph.D. Thesis) 1968 130 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-3869

The stability of LiH dimers with respect to the isolated diatomic system, LiH + LiH and Li_2 + H_2, was investigated using a classical ionic model and two semi-empirical quantum theories. Under the assumption that the cluster could be treated as a pseudo alkali halide dimer, the ionic model was investigated with the result that a D sub 2h diamond configuration was predicted stable with LiH distances 3.4 au and an energy 53.6 kcal/mole below that of the separated LiH monomers. Dissert. Abstr

N70-10094 Maryland Univ., College Park.
KINETICS OF EXCHANGE OF WATER BETWEEN THE COORDINATION SPHERE OF THE MONO (2, 2 PRIME, 2 DOUBLE PRIME-TERPYRIDINE) NICKEL (II) ION AND THE BULK SOLVENT BY MEANS OF OXYGEN-17 NUCLEAR MAGNETIC RESONANCE LINE BROADENING
David Parker Rablen (Ph.D. Thesis) 1968 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-7205

Measurements of the line widths of the O-17 nuclear magnetic resonance in O-17 enriched aqueous solutions of nickel(II) nitrate and the two complexes mono(2,2',2"-terpyridine) nickel(II) bromide and mono(diethylenetriamine)nickel(II) chloride were carried out over a substantial temperature range. The paramagnetic broadening of the O-17 resonance observed for the aquonickel(II) and mono(2,2',2"-terpyridine)-nickel(II) ions exhibited linear Arrhenius plots from which the first order rate constants and activation parameters for water exchange between the bulk of the solution and the first coordination sphere were determined. The paramagnetic broadening of the O-17 resonance in a solution of mono(diethylenetriamine)nickel(III) chloride displayed almost no change, within experimental error. Dissert. Abstr.

N70-10095 Rutgers Univ., New Brunswick, N.J.
STUDIES OF ANION CATALYSIS IN GALLIUM ELECTROCHEMISTRY
George Marshall Frame, II (Ph.D. Thesis) 1968 169 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-7537

The SCN-catalyzed was investigated in a.c. and d.c. polarography of Ga (III) reduction in acid media to assess the separate effects of variation in pH, ionic strength. The SCN concentration revealed (1) that the d.c. waves were unaffected on changing the pH from zero to the onset of hydrous oxide precipitation, which implied that the rate-controlling process is not dependent on a Ga (III)-hydroxy complex as in the case of indium; (2) that the rate of reduction, as judged from the increase in a.c. peak, increases significantly beyond 2.0 M. NaC104, and that diffusion controlled, d.c.-reversible waves could be obtained at ionic strengths; (3) that variation of corrected d.c. diffusion current vs Ga(III) concentration was linear. Dissert. Abstr.

N70-10098 Syracuse Univ., N.Y.
SOLUTION CONFORMATION AND SOLID-STATE CONFIGURATION OF POLY-L-ALANINE
Leslie Clarence Anderson (Ph.D. Thesis) 1968 127 p refs
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-7716

The fundamental correlation between the crystallized structure and the corresponding polymer chain conformation in solution is discussed. The polymer dimensions in solution (Radius of gyration (Rg) and persistence length (a)) were determined by small-angle X-ray scattering measurements. The solid-state structures were determined by a combination of X-ray diffraction, small-angle light scattering, optical and electron microscopy, infrared spectroscopy, and electron diffraction. Using a simple casting technique, spherulitic and random mat forms of PLA were cast from solutions of trifluoroacetic acid mixed with a nonsolvent trifluoroethanol and from pure TFA. Crystallization from the extended polymer conformations in TFA-TFE resulted in unique, highly perfected spherulites. Dissert. Abstr.

N70-10105 Texas A&M Univ., College Station.
ESR STUDY OF THE ANION RADICAL OF ANTHRAQUINONE AND THE COMPUTER ANALYSIS OF ESR SPECTRA
Billy Don Faubion (Ph.D. Thesis) 1968 68 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-8477

The anion radical of anthraquinone has been studied using electron spin resonance (esr) spectroscopy. Anion radicals were produced by electrolytic reduction and by reduction with alkali metals. The anion radical produced electrolytically was found to be essentially unassociated with any cation. The proton coupling constants for these spectra varied with the solvent used. In the metal reduction the anion radical and the metal cation were closely associated as ion-pairs. The degree of association was found to vary with temperature, solvent and metal cation. In the Na and K reduction spectra an alternation of line widths was observed. This line width alternation has been attributed to the intramolecular migration of the metal cation between the two oxygen atoms. In order to analyze the experimental spectra it was necessary to include in the theory of hyperfine interaction a mechanism for producing line width alternation. A computer program was written which can be used in the analysis of spectra which exhibit line width alternation. Dissert. Abstr.

N70-10110 Oklahoma Univ., Norman.
THE STRUCTURE OF ZINC GLYCYLGLYCYLGLYCINE; A PATTERSON SOLUTION METHOD; AND THE ATTEMPTED SOLUTIONS OF ACETYLPROLINE
Hugh Blackard Nicholas, Jr. (Ph.D. Thesis) 1969 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-8131

The crystal and molecular structure of the chelate of zinc(II) and glycylglycylglycine was solved using the classical Patterson-heavy atom methods and successive Fourier cycles. The zinc ion was revealed to be one of a group of metal ions with a well established pentaco-ordination. The coordination geometry is a moderately distorted trigonal bipyramid. The zinc is chelated through the amine terminal nitrogen and the first carbonyl oxygen of the peptide. Also the zinc is complexed to the carboxyl group of another peptide molecule. The only important deviation in the peptide chain is the slight but significant shortness of the C' sub 2 = O sub 2 bond which attributed to the weak and noncumulative interactions in these structures. The various attempts to solve the crystal structure of N-acetyl-1-proline are presented. Possible reasons for the failure of methods are proposed. Dissert. Abstr.

N70-10114# Bureau of Mines, Washington, D.C.
THE SYSTEM ALUMINUM CARBIDE-ALUMINUM NITRIDE-ALUMINUM OXIDE
Jack L. Henry, James H. Russell, and Hal J. Kelly Nov. 1969 28 p refs
(BM-RI-7320) Avail: Issuing Activity

The ternary system Al4C3-AlN-Al2O3 was examined to determine compositions which may display desirable high temperature refractory properties. Powder methods were employed in the synthesis of all test compositions. Forming and sintering behavior was examined and hot pressing parameters were measured. Several properties were studied for each composition of interest in the system. The properties included hydrolysis rate in moist air, elevated temperature oxidation rate, density, softening point, tensile strength, and rupture strength. In most cases equilibrium was not achieved, and the data are representative of a nonequilibrium system. Approximately 16 separate phases have been observed in the system. Forming behavior and selected properties of five compositions of interest were compared with those of aluminum oxide and aluminum nitride. None of the compositions compared favorably. Oxidation and vaporization appear to be serious drawbacks to the use of these compositions at elevated temperatures. Author

N70-10117 Iowa Univ., Iowa City.
DILUTE SOLUTION THERMODYNAMICS OF POLY-GAMMA-BENZYL-L-GLUTAMATE IN N,N DIMETHYLFORMAMIDE
Kenneth Douglas Goebel (Ph.D. Thesis) 1968 130 p refs
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-8737

The dilute solution thermodynamic behavior of polypeptides in helicogenic solvents, in which the polypeptide takes the shape of a highly asymmetric, rod-like particle, has been little investigated to date. In order to determine the thermodynamic behavior of such solutions and to what extent such behavior might differ from that predicted for solutions of coherent, impenetrable rods, the thermodynamic properties of dilute solutions of the polypeptide poly-gamma-benzyl-L-glutamate in the helicogenic solvent, N,N-dimethylformamide were investigated. Fractionated samples of the polypeptide were obtained by gradient elution chromatography using the Baker and Williams column. Number-average molecular weights of the fractions were determined from osmotic pressure measurements in N,N-dimethylformamide. Weight-average molecular weights of the fractions were determined from viscosity measurements. Dissert. Abst.

N70-10120# Purdue Univ., Lafayette, Ind.
THE STUDY OF METASTABLE IONS WITH A TIME-OF-FLIGHT MASS SPECTROMETER
William Frederick Haddon (Ph.D. Thesis) 1968 140 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-7453

The mass spectrometer used in this research was appropriately modified to defocus ions which interfere with metastable peaks, resulting in improved sensitivity for both collision-induced and unimolecular metastable ion measurement on the time-of-flight instrument. Improved calculation methods developed in this work permit for the first time an accurate calculation of the masses of metastable ions on the time-of-flight mass spectrometer. Similarities were found to exist between collision-induced metastable reactions and ion decomposition reactions occurring in the ion source. Many collision-induced metastables were observed for decomposition reactions which did not yield measureable unimolecular metastable peaks. The collision-induced metastable peaks were usually more intense than the equivalent unimolecular metastable ions. It was additionally possible to characterize the structure of an ion by the abundance of a single collision-induced metastable peak. Dissert. Abstr.

N70-10122 National Lending Library for Science and Technology, Boston Spa (England).

A SPECTROPHOTOMETRIC METHOD FOR THE DETERMINATION OF ALUMINIUM AND GALLIUM USING METHYLTHYMOL BLUE [SPEKTROFOTOMETRICHESKII METOD OPREDELENIYA ALYUMINIYA I GALLIYA S METILTIMOLOVYM SINIM]

N. D. Lukomskaya et al Aug. 1969 9 p refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii, Khim. i Khim. Tekhnol. (Ivanovo), v. 10, no. 9, 1967 p 994-996 (NLL-RTS-5293) Avail: Natl. Lending Library, Boston Spa, Engl.: 7s 6d

The reaction of the ions Al(3+) and Ga(3+) with the indicator methylthymol blue was found to be feasible for the spectrophotometric determination of microgram quantities of these ions in pure solutions. Preparation of the samples and the analytical solutions are described. Concentration of metallic ions was determined from calibration curves for gallium and aluminum. The relative error of the analysis, which is dependent on the magnitude of the metal concentration, is demonstrated graphically. M.H.E.

N70-10126 Delaware Univ., Newark.

TRANSITION METAL DINITRILE COORDINATION COMPLEXES

Monther Yousif Al-Janabi (Ph.D. Thesis) 1968 109 p Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-15,524

The primary objectives were two-fold: (1) the elucidation of the general coordinating properties of dinitriles when complexed with transition metals, i.e., their function as monodantate, chelating and/or bridging ligands; and (2) the synthesis of mu plus pi-bonded dinitrile complexes wherein the metal-nitrile bond is analogous to the metal-ethylene bond. The behavior of the NC(CH)nCN ligands, depending upon the value of n, can be divided into three different types: (1) when n=1, i.e., malononitrile, chelation takes place through the pi-bonds of both CN groups to the metal ion; (2) when n=2, i.e., succinonitrile, two kinds of bonding are observed, either chelation through the pi-bonds of the two CN groups to the same metal ion, or bridging between two metal ions; (3) when n=3 or 4, i.e., glutaro and adiponitriles, only bridging between two metal ions through the lone pair electrons of the nitrogen atoms is observed. Dissert. Abstr.

N70-10133 National Lending Library for Science and Technology, Boston Spa (England).

THE KINETICS OF CHLOROMETHYLATION OF p-DICHLOROBENZENE BY MONOCHLOROMETHYL ETHER [KINETIKA KHLORMETILIROVANIYA N-DIKHLORBENZOLA MONOKHLORMETILOVYM EFIROM]

B. P. Smirnov et al Jul. 1969 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. (Moscow), v. 11, 1968 p 48-51 (NLL-RTS-5181) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s

A spectrophotometric method was developed for the analysis of reacted mixtures of chloromethylated p-dichlorobenzene in an excess of monochloromethyl ether. The method enables the content of p-dichlorobenzene, 2,5-dichlorobenzyl-chloride, and 1,4-dichloro-2,5-bis(chloromethyl)benzene in the reacted mixture to be determined within about 1 percent of the total of the components. From the study of the kinetics of chloromethylation of p-dichlorobenzene by monochloromethyl ether at a molar ratio of 1:1000, it was shown that the process proceeds as a first order reaction as regards p-dichlorobenzene. The pre-exponential multiplier and energy of activation of the reaction were calculated. Author

N70-10135 Northwestern Univ., Evanston, Ill.

THE SURFACE CHEMISTRY OF CHROMIUM OXIDE CATALYSTS

Kathleen Christine Taylor (Ph.D. Thesis) 1968 233 p refs Avail: Univ. Microfilms: HC $10.60/Microfilm $3.05 Order No. 69-70002

The texture of chromium oxide gel and the nature of the surface sites for the chemisorption of oxygen, carbon monoxide, and ethylene were investigated as a function of the temperature of pretreatment. All measurements were made gravimetrically on a Cahn R. G. electrobalance. The B.E.T. surface area of the amorphous gel decreased from 304 to 209 m sq per gram of Cr2O3 for an increase in the activation temperature from 126 deg to 426 C. In these activations heating was in hydrogen to 300 C and in helium beyond. The nitrogen adsorption isotherms determined at -195 C were all type I indicating the presence of fine micropores which are filled at low relative pressures. The gel which was converted to microcrystalline alpha-chromia by heating in hydrogen at 450 C had a surface area of approximately 79 m sq per gram and exhibited a type IV adsorption isotherm with a hysteresis loop. Dissert. Abstr.

N70-10160*# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

PREPARATION OF HYDROGEN ISOTOPES BY CHROMATOGRAPHY IN A MOVING BED

Arlette Clayer et al [1968] 7 p refs Transl. into ENGLISH from Z. Anal. Chem. (Berlin), no. 236, 1968 p 240-249 (AEC-tr-6998) Avail: CFSTI

The principle of a continuous process is as follows: in a vertical column silicagel flows downward, by gravity, in a moving bed. The gaseous mixture to be separated (protium/deuterium) is introduced into the central portion of this column. Separation of the mixture into its two constituents is achieved by a counter-current exchange between the gaseous phase and the adsorbed phase. Protium less adsorbed is withdrawn at the top, deuterium is withdrawn at the bottom. The reflux is produced, at the bottom of the column, by two different means, depending on the type of desorption used: silicagel-desorption by rise of temperature and deuterium-elution by helium or displacing of deuterium by nitrogen. The gases produced are mixed with helium (1st case), or not (2nd case). Silicagel is carried again onto the top of the column by pneumatic transport. The experiments presented were carried out by means of nitrogen as displacing gas. Author (NSA)

N70-10189 Purdue Univ., Lafayette, Ind.

TAILORED SILICA ADSORBENTS

Ronald Earl Majors (Ph.D. Thesis) 1968 141 p Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-7477

Variables in a procedure for modifying the selectivity and capacity of silica, by precipitating silicic acid in the presence of the intended adsorbate, were studied so as to optimize these quantities and to improve the reproducibility. The chief factor affecting the xerogel selectivity for methyl orange relative to ethyl orange was the structure of the dye present during gelation. Capacity was increased by slow gelation rates, longer aging or drying times, and the use of pure methanol instead of acidified methanol or water for washing the gel. Repeated attempts to prepare stereoselective adsorbents for enantiomers resulted in failure, but improved adsorbents were successfully prepared for diastereomers. Dissert. Abstr.

N70-10195 Iowa Univ., Iowa City.

ANALYTICAL CHEMISTRY OF CHELATES OF 2-BENZOYLPYRIDINE-2-PYRIDYLHYDRAZONE

John Elmore Going (Ph.D. Thesis) 1968 171 p Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-8738

A series of substituted hydrazones were studied as potential reagents for the determination of transition metal ions. The complexes formed were studied spectrophotometrically. The ligand was varied in structure by changing the terminal substitutions on the hydrazone group, R1NH-N=CR2R3. It was found that, in order to form complexes of high molar absorptivities, the groups R sub 1 and R sub 2 or R sub 3 must contain electron donor groups located beta to the hydrazone group. The ligands then function as tridentates in forming six-coordinate bis complexes. After complexation, the secondary amine proton becomes labile and is easily removed by mild base. The resulting deprotonated complexes exhibit the analytically useful high molar absorptivities. Dissert. Abstr.

N70-10186 Seton Hall Univ., South Orange, N.J.
INTERACTIONS OF IONS WITH IONIC POLYSACCHARIDES IN AQUEOUS SOLUTION WITH AND WITHOUT ADDED SIMPLE ELECTROLYTE
Thomas Joseph Podlas (Ph.D. Thesis) 1968 185 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-7885

Counterion activity coefficients were determined potentiometrically using cation-selective electrodes, in aqueous solutions of the sodium and potassium salts of kappa- and lambda-carrageenan and alginic acid, and the potassium salt of arabic acid, with and without an added simple electrolyte having the cation in common with the counterion of the polyelectrolyte. Byion activity coefficients were also determined using a silver-silver chloride electrode for solutions of the carrageenans and potassium arabate containing added salt. The mean activity coefficients, expressed in terms of a membrane distribution coefficient, were also obtained for the sodium salts of carrageenan and alginic acid. Results of the activity coefficient measurements were interpreted using the concept of ion binding. Dissert. Abstr.

N70-10210 Lehigh Univ., Bethlehem, Pa.
THE INFRARED SPECTRA OF METHYL NITRATE AND METHYL THIONITRATE
Lloyd Joseph Male (Ph.D. Thesis) 1968 135 p refs
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-7345

Gas phase infrared vibration-rotation spectra and thin film solid state vibration spectra at 77 K of the asymmetric top molecules methyl nitrite, methyl-d3-nitrite, methyl thionitrite and methyl-d3-thionitrite were obtained with grating resolution over the 4000 to 140 cm region with a spectral slitwidth of approximately 0.4 cm. In addition, the Raman spectra of liquid methyl nitrite and methyl-d3-nitrite were obtained. The spectra of all of the molecules were assigned on the basis of a C_s symmetry model. The spectra of methyl nitrite were interpreted in terms of cis and trans rotational isomers. Three techniques were used to make the correct isomer assignment: observation of the temperature dependence of the infrared band intensities, a study of the infrared band shapes, and spectral comparison with analogous molecules. Dissert. Abstr.

N70-10216# Arizona Univ., Tucson. Chemistry Dept.
THE DOUBLET E TO QUADRUPLET A SUB 2 SPECTRA OF HEXAQUOCHROMIUM (3) CRYSTALS
F. Diomedi Camassei and Leslie S. Forster 1969 19 p refs
(PB-184635; COO-773-18) Avail: CFSTI CSCL 07D

The emission spectra of C (NH2)3Al (SO4)2.6H2O (GASH), C (NH2)3Al (SO4)2.6D2O (GASD), AlCl3.6H2O, and AlCl3.6D2O doped with Cr3+ were recorded at 4 and 77K. The two R lines are intense in both the 4 and 77K spectra of Cr3+: GASH and Cr3+: GASD, negating an interpretation in which the R lines are ascribed to the components of doublet E from quadruplet A sub 2 from a single species. The vibronic intervals within 350/cm of the origin are only slightly changed when H2O is replaced by D2O, whereas the energies of most vibrations in the 400-1000/cm range are much reduced by deuteration. Author (USGRDR)

N70-10228 Texas Christian Univ., Fort Worth.
MAGNETIC PROPERTIES OF THE OLIVINE SERIES: IRON SILICATE-MAGNESIUM SILICATE: MANGANESE SILICATE-MAGNESIUM SILICATE: IRON SILICATE-MANGANESE SILICATE
George Steven Hopper (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-741

The magnetic susceptibility of the three olivine series has been measured from 4.3 K to 300 K. The apparatus employed for these measurements was specially designed for the purpose, and employs a digital volt meter-digital printer combination in conjunction with a Cahn automatically recording electrobalance. All system components are synchronized by a control circuit, providing complete automatic operation. The inverse susceptibility-temperature curves have the characteristic shape of antiferromagnets for all samples measured. Dissert. Abstr.

N70-10232# Notre Dame Univ., Ind. Chemistry Dept.
QUANTITATIVE CONFORMATIONAL ANALYSIS Final Report, 1 Nov. 1964-30 Jun. 1969
Ernest L. Eliel 25 Jul. 1969 5 p refs
(Grants AF-AFOSR-772-65; AF-AFOSR-772-67)
(AD-691904; AFOSR-69-1995TR) Avail: CFSTI CSCL 7/4

This report gives a summary of accomplishments, personnel, and list of publications describing research on conformational analysis of heterocyclic systems, especially six membered rings. Author (TAB)

N70-10239# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF REACTION RATE CONSTANT FOR THE REACTION OF THE HYDROXYL RADICAL WITH HYDROGEN
V. V. Azatyan et al *In its* Combust. and Explosion Phys. 3 Feb. 1969 p 1-15 refs (See N70-10238 01-33)
Avail: CFSTI

The rate constant of the reaction of the hydroxyl radical with molecular hydrogen was determined by the explosion limit method. The reaction method used is given in formula. Based upon the given formula the equations are completed for the lower explosion limit in a form suitable for experimental verification. The author indicates that experiments are continuing in a wider temperature range. Author

N70-10252 Northwestern Univ., Evanston, Ill.
REDUCTION OF AMMONIUM AND TETRAALKYL GROUP 5 SALTS
Paul Jean Hoyer (Ph.D. Thesis) 1968 113 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-6940

The electrochemical reduction of ammonium ion on a mercury drop was found to form an amalgam which decomposed by two paths, one at the mercury-solution interface and the other inside of the drop. The rate of decomposition at the interface is much higher in water than in aprotic solvents. The interface decomposition also gives a catalytic appearance to the reduction. The decomposition within the drop causes stirring of the system when the duration of the experiment is long enough to have appreciable amounts of decomposition. The electrolytic or alkali metal reduction in glyme of ammonium and tetraalkyl group V salts was found not to lead to free radicals having appreciable lifetimes. The electron spin resonance signal of a solution of potassium in glyme was found to reversibly broaden and weaken rapidly with temperatures above -71 C. The evaporation of potassium onto ammonium chloride at 77 K was found not to lead to free radical products having appreciable lifetimes. Dissert. Abstr.

N70-10256 Virginia Univ., Charlottesville.
DISULFIDE STEREOCHEMISTRY: PROTON MAGNETIC RESONANCE AND CIRCULAR DICHROISM STUDIES OF OPTICALLY ACTIVE ALKYL DISULFIDES
Jeremiah Patrick Casey, IV (Ph.D. Thesis) 1968 171 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-3985

Numerous asymmetric acyclic and cyclic alkyl disulfides have been investigated by C.D. and 100 MHz P.M.R. The P.M.R. parameters and variable temperature effect on those parameters for S-methyl-L-cysteine, S-ethylthio-L-cysteine and L-cystine indicate endocyclic interactions need not be invoked to account for the P.M.R. spectrum of L-cystine and that qualitative rotamer distribution analyses may be applied to the cysteines and cystines. In an increasingly N-methylated series of L-cystine derivatives correspondence between qualitative rotamer distribution analyses and the sign and magnitude of the composite Cotton effect in the long wavelength disulfide region has been ascertained. A phenomenological correlation based on steric bulk induced rotamer preference is offered to rationalize a similar striking change of Cotton effect sign and magnitude in the disulfide absorption region for L-cystine diethyl ester hydrochloride in a series of homologous alcohols. Dissert. Abstr.

N70-10257 Catholic Univ. of America, Washington, D.C.
HYDROGEN ATOM REACTION WITH ETHYLENE AND THE LIFETIME OF CHEMICALLY-ACTIVATED ETHYL RADICALS
Toshitsugu Yokota (Ph.D. Thesis) 1968 191 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 69-9111

To investigate the rates of the reactions, the photolysis of H2S by a medium-pressure mercury lamp was performed in the presence of C2H4 (or C2D4) and CO2. The rate of formation of H2 (or H2 and HD) was measured under various pressures of the reactants and of CO2 at different temperatures. The basic plan of this work was to produce thermal hydrogen atoms through collisional deactivation by CO2 before the hydrogen atoms reacted.

N70-10265# Seton Hall Univ., South Orange, N.J.
PHOTOCHEMICAL TITRATIONS EMPLOYING PHOTOMETRIC END POINTS
Edward John Smith (Ph.D. Thesis) 1968 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-7886

Apparatus for continuous photochemical titrations using photometric end points have been designed, constructed, and evaluated. In photochemical titrations ultraviolet quanta are used directly as the titrant for photosensitive samples or quanta can be used to generate a suitable chemical titrant. Two fundamentally different design approaches were taken in the present study. The first involved the construction of an apparatus utilizing a medium-pressure mercury arc lamp both as the spectrophotometric source and as the source of photolysis radiation; the visible lines emitted by the lamp were used for photometric measurements and the ultraviolet emission spectrum was used for photolysis. Nephelometric measurements could also be made with the same apparatus with slight modification. The transmission mode was evaluated by titration of chromium(VI), vanadium(V), and potassium ferricyanide with iron(II) generated by the photolysis of iron(III)-oxalate. Dissert. Abstr.

N70-10267 Northwestern Univ., Evanston, Ill.
MASS SPECTROMETRIC INVESTIGATIONS OF HYDROGEN-CONTAINING MOLECULES OF BORON AND CARBON
Sara Jane Steck (Ph.D. Thesis) 1968 237 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.10 Order No. 69-6996

Molecular beam mass spectrometric studies of boron hydrides and integral furnace mass spectrometric studies of the high temperature reactions of hydrogen with graphite and with boron carbide-graphite mixtures have been carried out. Molecular beam mass spectra and ionization potentials have been obtained for the easily decomposed boron hydrides hexaborane-12 and octaborane-12. The molecular beam mass spectrum of octaborane-18 and the appearance potential of the ion B4H9(+) were measured. Preliminary experiments with n-nonaborane-15 and isononaborane-15 indicated the possibility of the presence of a new boron hydride in the n-nonaborane sample, and of octaborane-14 being the initial thermal decomposition product of iso-nonaborane-15. Boron-containing gaseous molecules have been identified as products of a high temperature reaction of hydrogen with boron carbide. A reaction mechanism involving addition and insertion reactions is discussed. Dissert. Abstr.

N70-10268 Arizona Univ., Tucson.
STRUCTURE AND PROPERTIES OF CERTAIN PLANAR METAL CHELATES AND THEIR ADDUCTS
Dean Edwin Carter (Ph.D. Thesis) 1969 200 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-7618

Some complexes between copper and 1-(2-pyridylazo)-2-naphthol (PAN) were studied in an effort to understand the stoichiometry, structure and bonding in these complexes. The crystal and molecular structure of the 1:1 copper-PAN complex, Cu(PAN) H2O(ClO4), was solved. The complex was found to be in a distorted square planar configuration. Some of the complexes showed identical visible spectra even though their elemental composition and mass spectra were different. Some bidentate nitrogen base adducts with bis(O,O'-dimethyldithiophosphato)nickel(II) (Ni(dmtp)2) were prepared and studied in an effort to understand the nature of adduct formation, particularly as applied to solvent extraction techniques. A brief study of the near infrared spectra of the adducts of Ni(dmtp)2 and 2,2'-dipyridyl and 1,10-phenanthroline indicated that species other than the 1:1 adduct were being formed. Dissert. Abstr.

N70-10269 Missouri Univ., Kansas City.
DIPHOSPHORUS TETRAHALIDES
Jack Loren Teague (Ph.D. Thesis) 1968 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-7226

P^{31}NMR studies were made of certain diphosphorus tetrahalide-phosphorus trihalide binary mixtures. New peaks were observed in the spectra of the mixtures, not observed in the spectra of the single compounds. The chemical shift of a tetrahalide phosphorus is determined only by the nature of the halide connected directly to it, and not by the nature of the halide connected to the second phosphorus atom in the compound. It had been shown previously that P_2Cl_4 is produced by the neutron irradiation of PCl_3. This work has indicated that similarly P_2Br_4 is formed during the neutron irradiation of PBr_3. The preparation of diphosphorus tetrafluoride was done both by the previously reported coupling of PF_2I with Hg, as well as by a new method. This method involves the reduction of PF_3 by white phosphorus in an electric discharge. The product was identified by mass spectrometry. Dissert. Abstr.

N70-10270 Iowa Univ., Iowa City.
APPLICATIONS OF SQUARE-WAVE POLAROGRAPHY
John Roger Bacon (Ph.D. Thesis) 1968 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-8703

The circuitry and construction of a square-wave polarograph is described. This instrument is very versatile in that most of the parameters controlling the instrument can be varied. These parameters are: frequency, gate position and duration, square-wave amplitude, voltage scan rate and direction, initial dc potential and

sensitivity. The instrument is a composite of transistorized and tube type circuitry. The square-wave polarograph is used to monitor the effluents from an ion exchange column. This polarograph acts as a highly specific detector for a particular metal ion if the summit potential of that metal ion is applied at the dropping mercury electrode. Other summit potentials can be applied to produce a specific detector for other metal ions. Dissert. Abstr.

N70-10271 City Univ. of New York.
ULTRAVIOLET ABSORPTION SPECTRA OF VINYLARSINES AND VINYLPHOSPHINES
George Pasternack (Ph.D. Thesis) 1969 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-7606

A series of vinylarsines and vinylphosphines has been prepared and their ultraviolet absorption spectra recorded. Each of the trivalent derivatives exhibits a single peak in the ultraviolet region above 220 mμ, together with a second intense absorption at shorter wavelengths which shows no maximum above 200 mμ. The longer wavelength absorption peak disappears upon oxidation of the trivalent derivatives. In the second part of this study, spectroscopic evidence has been obtained to demonstrate the effectiveness of a tervalent (as well as a pentavalent) phosphorus atom in withdrawing an excess of negative charge from an alpha position. For this study, compounds were prepared in which a second phosphorus atom was substituted vicinal to the phosphorus atom in di-n-butylvinylphosphine. Dissert. Abstr.

N70-10273# Naval Research Lab., Washington, D.C. Lab. for Chemical Physics.
EFFECT OF ADSORBED MONOMOLECULAR FILMS ON THE EVAPORATION OF VOLATILE ORGANIC LIQUIDS Interim Report
Marianne K. Nernett, Laura A. Halper, N. L. Jarvis, and T. M. Thomas 9 Jul. 1969 19 p refs
(AD-692383; NRL-6931) Avail: CFSTI CSCL 7/4

An investigation was made of the effect of adsorbed surface-active films on the rate of evaporation of volatile organic liquids. A series of partially fluorinated compounds were studied either as monolayers adsorbed from solution or as insoluble films spread at the liquid/vapor interface. In no instance was the rate of evaporation significantly reduced by the presence of a monomolecular film. Insoluble multimolecular films of polydimethylsiloxanes, however, were found to reduce effectively the rate of evaporation, provided the film thickness was sufficient to decrease the rate of diffusion of the solvent molecules through the film to a value below their rate of diffusion through the saturated, nonturbulent vapor layer overlying the surface. In addition to polydimethylsiloxane polymolecular layers, thin layers of water, containing suitable fluorocarbon spreading agents, were also found to reduce the rate of evaporation of certain volatile organic liquids. These aqueous films are similar to the thin layers of interlamellar water present in aqueous foams used to extinguish gasoline fires, such as the fluorocarbon-containing Light Water foams. Author (TAB)

N70-10276 Carnegie-Mellon Univ., Pittsburgh, Pa.
A STUDY OF SOME NEW SILICON GERMANIUM AND TIN HYDRIDE DERIVATIVES
Narayanasamy Viswanathan (Ph.D. Thesis) 1968 178 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-7906

The new compound methoxydimethylsilane, $CH_3OSiH(CH_3)_2$, has been prepared by the action of methanol on bisdimethylsilyl sulfide. A similar reaction with bistrimethylsilyl sulfide gave methoxytrimethylsilane, $CH_3OSi(CH_3)_3$. The reaction of an alcohol on silyl or alkyl substituted silyl sulfides seems to be a general route for the preparation of alkoxysilanes. It will be a convenient route to other organosilicon and silcon hydride alkoxide derivatives. Methoxydimethylsilane has been characterized by its infrared, mass and proton magnetic resonance spectra. Other physical and chemical properties of $CH_3OSiH(CH_3)_2$ have also been determined. In addition, the Lewis basicity of $CH_3OSiH(CH_3)_2$ has been measured relative to $CH_3OC(CH_3)_3$, $CH_3OSi(CH_3)_3$, and $CH_3OSiH_2CH_3$ by an infrared hydrogen bonding study. Dissert. Abstr.

N70-10275# European Atomic Energy Community, Ispra (Italy). Chemistry Dept.
PHENYLATION OF BIPHENYL, o- AND m-TERPHENYL AND THEIR MIXTURES WITH BENZOYLPEROXIDE. DETERMINATION OF RELATIVE REACTIVITIES AND PARTIAL RATE FACTORS
H. Stangl and G. Juppe 1969 59 p refs
(EUR-4257-e) Avail: CFSTI

The phenylation of biphenyl, o- and m-terphenyl with benzolperoxide as phenyl radical generator is investigated. All expected terphenyl- such as quater- phenyl-isomers are formed and are determined by gas chromatography. In addition to well-known products from benzoylperoxide decomposition, small amounts of benzene are found qualitatively in all experiments, and traces of biphenyl in the case of terphenyl solvent. Relative reactivities for the phenylation are determined from competition experiments with the three polyphenyl solvents, using a new method in evaluating the experimental results. The earlier procedure is critically discussed and compared. Rate constants relative to biphenyl are 1.40 + or − 0.08 for o-terphenyl and 1.66 + or −0.1 for m-terphenyl. The value of 1.18 for m-terphenyl reactivity relative to o-terphenyl, calculated from the above results, is also evaluated experimentally from a competition experiment. Partial rate factors for the different molecule positions are determined from isomer ratios and the influence of resonance stabilization and steric hindrance is discussed. Numerical increments for these contributions, deduced by this analysis, allow a rough calculation of the probable reactivity of p-terphenyl against phenyl radicals (2.3 compared to biphenyl). A first estimation is made on this basis also for quaterphenyl and triphenylbenzene reactivities. Author

N70-10293 Drexel Inst. of Tech., Philadelphia, Pa.
PYROLYSIS AND THERMOGRAVIMETRIC ANALYSIS OF DODECYL THIOL ESTERS
Winfred Evans Parker (Ph.D. Thesis) 1969 140 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-7017

Thermal decomposition of dodecyl thiol esters have been studied by pyrolytic methods and thermogravimetric analysis. Although oxygen esters can be pyrolyzed at 500 to 525 C., a temperature of 600 to 610 deg was required to achieve a reasonable amount of decomposition for thiol esters. The esters showed remarkable stability at high sample feed rates even at this temperature. The major products of decomposition were pentene-1, hexene-1, cyclopentadiene, thioallyl alcohol, dodecene-1, and naphthalene. The kinetic parameters indicate that the principal reaction is a unimolecular surface reaction involving adsorption of the molecule at the sulfur atom of the thiocarboxyl group before double bond formation occurs. The detailed mechanism proposed is essentially the reverse of the hydrogenation of an alkene on the surface of a catalyst. Dissert. Abstr.

N70-10294 National Lending Library for Science and Technology, Boston Spa (England).
FILM-FORMING CARBOXYLATE LATEX BASED ON A COPOLYMER OF VINYL ACETATE AND METHYL ACRYLATE [KARBOSILATNYI PLENKOOBRAZUYUSHCHII LATEKS NA OSNOVA SOPOLIMERA VINILATSETATA S METILAKRILATOM]

V. I. Eliseeva et al Jul. 1969 11 p refs Transl. into ENGLISH from Lakokrasochnye Materialy i Ikh Primenenie (Leningrad), no. 2, 1967 p 19–22
(NLL-RTS-5250) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s

Carboxyl-containing methyl acrylate (MA) and vinyl acetate (VA) copolymer latexes with different carboxyl group contents have been synthesized and studied for their film-forming capacity. Additions of up to 5% methacrylic acid (MAK) to the copolymer increase the colloidal stability of the latex; when 7% MAK is added the film becomes stronger in the absence of fillers and its water absorption is reduced. The pH of copolymer latexes containing carboxyl groups influences their water absorption and loss in weight after prolonged immersion in water. Laboratory and pilot plant samples of the latexes have been used to formulate water-emulsion paints, and the samples have been tested. Optimum properties as a film-former are found in the MA–VA copolymer with 1.5% MAK. R.B.

N70-10300 Washington Univ., Seattle.
THE HYDROGEN ATOM EXCHANGE REACTION OF TRI-T-BUTYLPHENOXY RADICAL AS STUDIED BY ELECTRON SPIN RESONANCE AND STOPPED FLOW TECHNIQUES
Martin Richard Arick (Ph.D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-8981

The objective of this study was to measure the rate constant of the hydrogen atom exchange reaction of tri-t-butylphenoxy radical with its diamagnetic precursor. The techniques of stopped flow and electron spin resonance (ESR) were combined. The stopped flow technique was used to rapidly mix together solutions of tri-t-butylphenoxy radical and di-deuterio-tri-t-butylphenol. After mixing, the solutions were driven into the viewing chamber which was mounted inside the cavity of the ESR spectrometer. Since one of the reactants was an organic free radical, the course of the reaction was followed by ESR spectroscopy. The kinetics of the reaction was second order, but all kinetic curves which followed the course of the reaction showed pseudo-first order behavior. Imidazole was introduced into the reaction system that used acetone as the solvent. It was found that the rate constant for the reaction increased with increasing imidazole concentrations but decreased at high imidazole concentration. Dissert. Abstr.

N70-10321 Carnegie-Mellon Univ., Pittsburgh, Pa.
AN INVESTIGATION OF MOLECULAR COMPLEXING AND ITS EFFECT ON ACID-BASE EQUILIBRIA BY A POTENTIOMETRIC METHOD
David Buben (Ph.D. Thesis) 1968 200 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-7899

The effect of donor-acceptor complexing upon several organic donor acid-donor base equilibria was studied by a potentiometric technique. The pH of a donor buffer was precisely determined at several concentrations of added neutral acceptor by a titrimetric procedure. Observed pH changes were attributed to enhancement or reduction of donor acidity due to the electronic effects associated with complexing. Experimental data were analyzed by computer according to an assumed system of interrelated equilibria involving donor acid-acceptor association, donor base-acceptor association, ionization of uncomplexed donor acid and ionization of complexed donor acid. Donor-acceptor association constants obtained by this analysis agreed well with those obtained by established methods. Electrostatic effects appeared to be important in governing the behavior of systems having certain charge types. Dissert. Abstr.

N70-10322 Carnegie-Mellon Univ., Pittsburgh, Pa.
THERMODYNAMIC CONSIDERATIONS. PART 1: THERMOCHEMISTRY OF TRANSITION METAL COMPOUNDS. PART 2: VOLUMETRIC PROPERTIES OF DILUTE AQUEOUS ELECTROLYTE SOLUTIONS
Lewis Morton Gedansky (Ph.D. Thesis) 1968 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-7902

In order to remove existing discrepancies and to provide new data concerning the chemical thermodynamic properties of several transition metal compounds, heats of solution, heats of precipitation and heats of reaction have been investigated using an isothermal solution calorimeter. The experimental results have been combined with existing thermodynamic data to lead to new thermodynamic values. Since the calorimetric investigations involved aqueous solutions, the thermodynamic properties for the aqueous ions of the transition elements have also been considered. The structure of liquid water and the effect of added solute molecules on the structure by volumetric properties of dilute aqueous electrolyte solutions have been investigated. Dissert. Abstr

N70-10324 Iowa Univ., Iowa City.
AN INVESTIGATION OF NICKEL COMPLEXES AS ADSORBENTS IN GAS-SOLID CHROMATOGRAPHY
Lawrence Eugene Cook (Ph.D. Thesis) 1968 130 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-8714

This investigation involved a study of the retention characteristics of various classes of organic compounds on a series of gas chromatography columns that had nickel complexes as stationary phases. The complexes investigated as stationary phases were bis(dimethylglyoximato)nickel(II), bis(cyclohexanedionedioximato)nickel(II), and bis(salicylaldimino)-nickel(II). A different method for the coating of solid supports with slightly soluble stationary phases is described. Columns of varying amounts of stationary phases were prepared and studied at 50C., 85C., and 125C. The parameters studied on each column were: per cent stationary phase, retention volume, column efficiency as a function of carrier gas velocity, effect of carrier gas on retention volume, dependence of retention volume on sample size, heats of adsorption, and separation ability. The general rule was that hydrocarbons tailed less than oxygen-containing compounds which in turn tailed less than compounds containing a nitrogen atom. Dissert. Abstr.

N70-10325 Rensselaer Polytechnic Inst., Troy, N.Y.
CHROMIUM(II) OXIDATION AT PLATINUM ELECTRODES
Robert J. Ferrauto (Ph.D. Thesis) 1968 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-6458

The oxidation of Cr(II) at oxide-free and oxidized platinum electrodes has been studied in 1 M HClO4 and varying concentrations of chloride. A mechanism involving adsorption of solution impurities has been invoked to explain deactivation of the platinum electrode for controlled potential coulometry experiments in the potential region of oxide-free platinum. This mechanism was also found applicable for explaining a large overvoltage for Cr(II) oxidation in single sweep voltammetry at a rotating platinum electrode. Chloride ion was found to have a large accelerating effect on the oxidation of Cr(II), at oxide-free platinum. The chloride functions in two ways: desorbing impurities on the electrode surface, and by providing an electron bridge for Cr(II) oxidation. Electrooxidation of Cr(II) was found to be hindered slightly in the presence of platinum(II) surface oxides as demonstrated by cyclic voltammetry at a rotating platinum disc electrode, however, enhanced in the same potential region for controlled potential coulometry. Dissert. Abstr.

N70-10326 Lehigh Univ., Bethlehem, Pa.
THE DIELECTRIC BEHAVIOR OF ADSORBED WATER FILMS ON IRON OXIDES
Edward Mc Cafferty (Ph.D. Thesis) 1968 213 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 69-7347

The purpose of this investigation was to study the adsorption of water vapor on alpha-ferric oxide at 5 to 35 C and to examine the possibility of electrolytic transport in thin water films on the oxide surface. The dielectric properties of the water/alpha-Fe2O3 system were monitored along the adsorption isotherm for frequencies of 70 c/s to 300 kc/s. Measurement of the electrical capacitance showed that the first layer of physically adsorbed water on the hydroxylated oxide surface was immobile; the second layer was mobile. Calculation of the dielectric relaxation time of the system through measurement of the dielectric loss and computer analysis of Cole–Cole are plots showed that the build-up of water films occurred in three stages. These stages are the formation of: (1) an immobile first layer, (2) a mobile second layer, and (3) a hydrogen bonded ice-like structure in the next few BET layers. These observations are important in elucidating the mechanism by which rusted metals continue to corrode in the atmosphere.
Dissert. Abstr.

N70-10327 Stanford Univ., Calif.
PART 1: THE STEREOSPECIFIC ALKYLATION OF BENZENE WITH GAMMA-VALEROLACTONE. PART 2: THE MECHANISM OF THE PERMANGANATE OXIDATION OF TERTIARY HYDROGENS
Alexander Jerry Pandell (Ph.D. Thesis) 1968 190 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-8236

The alkylation of benzene with S-(-)-gamma-valerolactone (I) and 1.25 equiv of aluminum chloride in benzene solvent gave R-(-)-gamma-phenylvaleric acid (II) with 40% net inversion of configuration. This constitutes the first observation of a Friedel–Crafts reaction with extensive stereochemical integrity. A detailed study of the reaction was made.
Dissert. Abstr.

N70-10336# San Francisco Univ., Calif.
BIOCHEMICAL PHARMACOLOGY OF HYDRAZINES TOXICITY
Arthur Furst, Waldemar R. Gustavson, Rober deRopp May 1969 41 p refs
(Contract AF33(615)-3829)
(AD-692509; AMRL-TR-68-132) Avail: CFSTI CSCL 6/1

The toxic action of 1-1-dimethylhydrazine (UDMH) and monomethylhydrazine (MMH) may be mediated by the inactivation of pyridoxal in the brain. One possibility considered was the formation of a hydrazone between the pyridoxals and the substituted hydrazine. Pyridoxal dependent enzymes were investigated. UDMH and MMH inhibited both glutamic acid decarboxylase and DOPA decarboxylase. Transaminases (amino transferases) which required alpha-ketoglutaric acid as a substrate were not affected by the hydrazines tested. Further work was conducted to refine an ultrasensitive bioassay method for the detection of each congener of the vitamin B6 group. The microorganisms investigated for the assay were a neurospora and a yeast. Some indirect evidence was obtained which implies that UDMH injected intraperitoneally can be detected in the central nervous system. A mathematical model for hydrazines-induced convulsions was developed. It is now possible to predict the time lapse after administration of the convulsigen and the onset of seizure if only three data points are given.
Author (TAB)

N70-10339 Northwestern Univ., Evanston, Ill.
KINETICS AND MECHANISM OF LINKAGE ISOMERIZATION OF A THIOCYANATOPALLADIUM(2) COMPLEX
Kevin Joel Weidenbaum (Ph.D. Thesis) 1968 137 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-7006

In this work, linkage isomers of [Pd(Et4dien)SCN]+, where Et4dien is (C2H5)2N C2H4 NH C2H4 N(C2H5)2, were prepared and the unstable isomer was determined to be S-bonded. The assignment, using infrared and ultraviolet spectroscopy, was unequivocal. The complex isomerized in the solid state and in solution. For an aqueous solution at 25 deg the first-order rate constant is 0.0004 sec to the minus one power and is unaffected by thiocyanate ion concentration. For a given temperature the bromide substitution of the S-bonded complex takes place at the same rate as isomerization; it also is not influenced by the concentration of bromide ion. The bromide substitution of the N-bonded complex takes place at a slower rate than the other reactions. An exchange reaction using radioactive KSCN indicated that the complex picks up thiocyanate ions at roughly the same rate as it isomerized.
Dissert. Abstr.

N70-10353 National Lending Library for Science and Technology, Boston Spa (England).
THE REACTION KINETICS OF ANILINE ACYLATION WITH BENZOYL CHLORIDE IN ANHYDROUS MEDIA; PART 5 [KINETIKE REAKTSII ATSILIROVANIYA ANILINA BENZOILKHLORIDOM V NEVODNYKH SREDAKH, 5]
N. K. Vorob et al May 1969 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Technol. (Moscow), no. 1, 1966 p 53–57
(NLL-RTS-5124) Avail: Natl. Lending Library, Boston Spa, Engl.: 12s 6d

The heat of mixing one mole of aniline or benzoyl chloride reagent in an infinitely dilute solution reflects the energy of interaction between the component molecules. Compatibility has been established between aniline and benzoyl chloride and the relative frequency displacements, depending on the solvent, which correspond to the N—H bond in aniline and the C=O bond in acetylchloride. There is a relationship between the basicity of the solvent and relative frequency displacement of the N—H bond in aniline, and also between the basicity of the solvent and the heat of mixing with these solvents. The effect of the solvent on the rate of aniline benzoylation is believed to be primarily related to the interaction of the aniline with the solvent molecules.
R.B.

N70-10354 National Lending Library for Science and Technology, Boston Spa (England).
THE INTERACTION OF TITANIUM DIOXIDE WITH POLYSTYRENE LATEX [VZAIMODEISTVIE DVUOKISI TITANA S POLISTIROLNYM LATEKSOM]
N. A. Shabanova et al Jul. 1969 11 p refs Transl. into ENGLISH from Tr. Mosk. Fiz.-Techn. Inst. (Moscow), no. 49, 1965 p 187–189
(NLL-RTS-5196) Avail: Natl. Lending Library, Boston Spa, Engl.: 7s 6d

The addition of titanium dioxide to latex with adsorption saturation of the protective coating lowers the resistance of the system to mixing. Introduction of titanium dioxide to the latex causes a transfer of the soap molecules from the polymer globules to the particles of the pigment. This is confirmed by the change in the hydrophilic nature of the pigment and the formation of thixotropic, coagulated structures. Modification of the pigment surface particles by treatment with latex alters the hydrophilic or hydrophobic nature depending on the degree of saturation of the protective coatings of the original latex.
R.B.

N70-10357 National Lending Library for Science and Technology, Boston Spa (England).
THE STATE OF MOLECULAR HYDROGEN, CARBON MONOXIDE, AND ETHYLENE CHEMISORBED ON METALS, THE REACTIVE CAPACITY OF SURFACE CARBONYLS AND THE CATALYTIC ACTIVITY OF PLATINUM METALS [O SOSTOYANII H SUB 2, CO, I C SUB 2 H SUB 4 KHEMISORBIROVANNYKH NA METALLAKH, REAKTSIONNOI SPOSO BNOSTI POVERKHNOSTNYKH KARBONILOV I KATALICHESKOI AKTIVONSTI PLATNOVYKH METALLOV]
N. N. Kavtaradze et al. Jul. 1968. 12 p. refs. Transl. into ENGLISH from J. Res. Inst. Catalysis, Hokkaido Univ. (Sapporo), v. 16, no. 1, 1968 p 491–499. (NLL-RTS-5278)
Avail: Natl. Lending Library, Boston Spa, Engl.: 40d

Results of chemisorption of carbon monoxide, ethylene, and hydrogen on platinum metals are described and a comparative analysis was made of data regarding structure, thermal stability, and reactive capacity of the surface compounds formed. It was established that the catalytic activity of metals in a number of processes is revealed when they are subjected to chemisorption by both components. It was demonstrated that the chemisorptive capacity and the catalytic activity of metals depend on their position in the periodic table. Author

N70-10360# United Aircraft Corp., East Hartford, Conn. Research Labs.
MEASUREMENT OF NO PLUS Cs CHARGE EXCHANGE CROSS SECTIONS Final Report, 1 Sep. 1967–31 Mar. 1969
Thomas L. Churchill and Robert H. Bullis. 30 Jun. 1969. 56 p. refs. Supported in part by DASA
(Contract F19628-67-C-0409)
(AD-691272; UARL-H920599-7; AFCRL-69-0198) Avail: CFSTI CSCL 7/4

The charge-exchange cross section was measured for the NO(+) + Cs reaction over a relative energy range of 0.65 to 8.3 eV in a 90 deg crossed-beam experiment. In these measurements an electroformed collision chamber was employed to eliminate the usual uncertainties associated with the determination of the energy of charged particle beams at low energies. In addition, it was found that the appearance of vibrational excitation in the NO(+) ground state ion significantly increases the probability for charge exchange with cesium at a fixed relative energy. Author (TAB)

N70-10363 Georgetown Univ., Washington, D.C.
THE INTRINSIC AND IMPURITY-INDUCED ULTRAVIOLET SPECTRA OF SILICATES GLASSES
George Henry Sigel, Jr. (Ph.D. Thesis) 1968 146 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-2075

The ultraviolet absorption spectra of high purity silicate glasses was investigated in the region extending from 90 to 360 nm. Impurity-induced absorption was found to predominate at wave-lengths greater than 200 nm. Absorption due to ferric and ferrous iron constituted the major portion of this absorption. The difference in the ultraviolet absorption which results when many glasses are melted under reducing and oxidizing conditions, was explained on the basis of a change in the valence state of the iron impurity. The introduction of network modifiers such as lithium, sodium, and potassium into silica was found to produce a strong absorption band near 170 nm. The introduction of aluminum was effective in eliminating this absorption band this type are expected. A radiation-induced band in high purity silicates at 5.4 eV was identified as that resulting from the transfer of an electron trapped at a non-bridging oxygen to a network silicon which had lost an electron through breaking of a Si-O bond during the irradiation with X-rays. Dissert. Abstr.

N70-10367*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
QUANTITATIVE DIRECT-CURRENT ARC ANALYSIS OF RANDOM COMPOSITIONS OF MICROGRAM RESIDUES IN SILVER CHLORIDE COMMON MATRIX
William A. Gorden and Gilbert B. Chapman. Washington, Nov. 1969. 23 p. refs
(NASA-TN-D-5532; E-5278) Avail: CFSTI CSCL 07B

A procedure is described for spectrochemical analysis of random compositions of 20 elements in the concentration range from 0.1 to 100 percent. Samples are microgram residues derived from dissolution of metal samples. Calibration curves, one for each element, are prepared over the range from 0.01 to 10 micrograms. Absolute amounts of analyte elements and their percentage concentration are determined from these curves for all compositions. Analyses of some alloy standards with and without use of comparison standards are reported as examples of results attainable. No matrix effects attributable to excitation suppressions or enhancements were found. Author

N70-10374 Lehigh Univ., Bethlehem, Pa.
A RATE MODEL FOR THE LOW TEMPERATURE CATALYTIC ORTHO-PARAHYDROGEN REACTION
Alan Herbert Singleton (Ph.D. Thesis) 1968 146 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-7360

Measurements were made of the low temperature ortho-parahydrogen reaction rate obtained with an extremely active nickel oxide-silica gel catalyst. A satisfactory model, based on a first order reversible rate equation, was developed to explain the observed kinetics. The successful use of the model required the evaluation of the equilibrium composition based on the temperature at the surface of the catalyst, as calculated from constant temperature bath temperature and the several temperature gradients across the reactor. A modified form of the Thiele modulus was used to account for the pore diffusional limitation to the overall reaction rate. A novel curve fitting technique was developed for analyzing a portion of the data to determine the pore diffusion coefficients required for the use of the Thiele Modulus approach. The reaction rate model fit the data over a temperature range of 142.5 to 168.5 R and a pressure range of 100 to 1500 psia, and applied equally well to the reverse reaction direction. Dissert. Abstr.

N70-10395 Syracuse Univ., N.Y.
POLARIZED INFRARED STUDY OF SINGLE CRYSTAL SULFAMIC ACID
Marguerite Ann Boisvert (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-7722

Polarized infrared spectra of single crystal sulfamic acid were taken, and the fundamentals of group theory were applied in the interpretation of these spectra. It was shown that all sulfamic acid molecular vibrations belonging to a given molecular symmetry species should exhibit similar changes in absorption intensities when the plane of polarization of the incident infrared radiation is altered relative to crystal orientation. Using this information and the data from a low temperature single crystal spectrum, assignments were made for fundamental, overtone, and combination bands. These assignments show general agreement with the results of earlier sulfamic acid studies. Dissert. Abstr.

N70-10416# Hough Lab., Springfield, Ohio.
INVESTIGATION OF UNIQUE ORGANOMETALLIC COMPOUNDS AS POTENTIAL FIRE EXTINGUISHANTS
Ralph L. Hough. Wright-Patterson AFB, Ohio AFAPL Mar. 1969. 33 p. refs
(Contract F33615-69-C-1315)

(AD-692102; AFAPL-TR-69-42) Avail: CFSTI CSCL 13/12

A study was performed to determine the feasibility of using volatile halogenated organooxymetallic compounds for extinguishing diffusion flames. Because these compounds decompose thermally, yielding halogenated liquids and gases as well as the respective metal oxides, it was postulated that they would function as fire extinguishing agents when deployed into a region filled with flames. A rapidly moving cloud of gas phase nucleated particulates, having a very high surface to mass ratio, together with the attending halogenated species would have a degree of flame penetration not available in gaseous or liquid agents alone. Organooxymetallics having branched fluorinated ligands are more volatile than straight chain or unfluorinated analogs. The 1, 1, 1, 3, 3, 3-hexafluoro-2-propoxy ligand was investigated utilizing a special diffusion burner designed for this research. Experimental difficulties were encountered in burner design and operation. Considering this, it appears that compounds as tetrakis 1, 1, 1, 3, 3, 3-hexafluoro-2-propoxy silicon and 1, 1, 1, 3, 3, 3-hexafluoro-2-propanol are as effective as bromotrifluoromethane in extinguishing small propane-air diffusion flames. Author (TAB)

N70-10421# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.

ON THE COMPLEX CHEMICAL BEHAVIOR OF THE TRIFLUOROPHOSPHINES WITH RHENIUM AND TUNGSTEN [UEBER DAS KOMPLEXCHEMISCHE VERHALTEN DES TRIFLUORPHOSPHINS MIT RHENIUM UND WOLFRAM]

Albrecht Engelmann (Ph.D. Thesis) 1969 117 p refs In GERMAN

Avail: CFSTI

By preparing trifluorophosphine complexes of rhenium and hexakis(trifluorophosphine) tungsten(0), it was possible to extend the complex chemistry of trifluorophosphine to the subgroup VII and to add the missing member of the subgroup VI to the homologous series of the hexakis (trifluorophosphines). The synthesis of pentakis (trifluorophosphine) rhenium compounds yielded complexes which contain the central metal in the formal oxidation levels −1, 0, and +1. Potassium pentakis (trifluorophosphine rhenate(I) results when shaking chloro pentakis (trifluoro phosphine) rhenium with potassium amalgam. The synthesis of hydrido pentakis (trifluorophosphine) rhenium is described, and it was established that hydrogen is contained as a genuine sixth ligand in this octahedral complex in addition to the five trifluorophosphine groups. The thermal dissociation of pentakis (trifluorophosphine) rhenium complexes yields the meta-dihalogeno tetrakis (trifluorophosphine) complexes. The experimental methods and spectral characteristics of the complexes are described in detail.

Transl. by K.W.

N70-10449# Monsanto Research Corp., Dayton, Ohio.

MOLECULAR STRUCTURE AND MATERIALS CHARACTERIZATION Annual Summary Report, 1 Mar. 1968 - 28 Feb. 1969

W. R. Fearheller AFML Jun. 1969 42 p refs

(Contract F33615-67-C-1363)

(AD-692105; MRC-DA-195; AFML-TR-69-118) Avail: CFSTI CSCL 7/4

Summaries are presented of published papers resulting from research on the use infrared spectra to determine molecular structure. Included is a discussion on the low-temperature infrared spectra of sugars, of halogenated aliphatic acids, of amino acids and simple polypeptides, of inorganic compounds, of oxygen in fluorine organic compounds, and of Friedel-Craft intermediates. Author (TAB)

N70-10474# Pennsylvania State Univ., University Park. Dept. of Chemistry.

CHEMICAL REACTIONS IN IONIC MATRICES

I. C. Hisatsune Aug. 1969 36 p Transl. into ENGLISH from Nippon Kagaku Zasshi (Tokyo), v. 89, no. 12, Dec. 1968 p 1143-1156 In ENGLISH and JAPANESE

(Grant AF-AFOSR-0907-67)

(AD-692239; AFOSR-69-2041-TR) Avail: CFSTI CSCL 7/2

Pressed alkali halide disks, which are used commonly to obtain the infrared spectra of solid compounds, are found to be convenient matrices in which solid state chemical reactions of organic ions can be examined. These reactions can be induced thermally or by irradiation, and their kinetics can be followed spectroscopically. In thermal decomposition reactions involving weight changes, the kinetic results obtained with these disks be infrared spectroscopy agree with those from the thermogravimetric analysis. In gamma irradiation studies, ion free radicals are trapped readily in these disks even at room temperature, and the decay of these radicals can be followed by electron spin resonance spectroscopy. When the concentrations of these radicals are sufficiently great, their chemistry as well as their absorption spectra can be investigated. Experiments carried out to date indicate that the use of pressed disks can extend the field of solid state chemical kinetics and matrix isolation studies. Author (TAB)

N70-10494# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.

INVESTIGATION OF DEFECTS IN ICE USING POSITRON ANNIHILATION (PROJECT PAN) Final Report

William A. Livingston and Dennis P. Malone 30 Sep. 1968 61 p refs

(Contract Nonr-4885(00); Proj. PAN)

(AD-692118; CAL-RM-2086-P-1) Avail: CFSTI CSCL 20/12

Water substance, at temperatures below and just above its melting point, is not a pure liquid or solid as classical approaches would suggest. Rather, it is evident that at temperatures just above the melting point the liquid phase contains molecular groupings which, because of temporary bonding, have more ice-like than liquid-like characteristics. Similarly, at temperatures colder than zero degrees Celsius liquid-like clusters of molecules exist on a statistical basis. Indeed, a three-component behavior is adduced, the relative importances of the three as controlling phenomena being different as temperature is altered. Because electronic bonds in hydrogen are involved in these interior changes of state, the phenomenon is amenable to study by the method of positron annihilation. In such an investigation, the existence of temporarily broken electron bonds (defects) is statistically assessable because the (defect) electrons are more likely than bound ones to combine with positrons in the annihilation process. This report provides a theoretical background and outlines and experimental attack on the problem of this defect structure in liquid water and ice. Author (TAB)

N70-10514 Brigham Young Univ., Provo, Utah.

THE THERMODYNAMICS (LOG K, DELTA H DEG, DELTA S DEG, DELTA Cp DEG) OF METAL LIGAND INTERACTION IN AQUEOUS SOLUTION. PART 1: DESIGN AND CONSTRUCTION OF AN ISOTHERMAL TITRATION CALORIMETER. PART 2: THE INTERACTION OF CYANIDE ION WITH BIVALENT NICKEL, ZINC, CADMIUM AND MERCURY. PART 3: THE INTERACTION OF GLYCINATE ION WITH BIVALENT MANGANESE, IRON, COBALT, NICKEL, COPPER, ZINC AND CADMIUM

Harlin Dee Johnston (Ph.D. Thesis) 1968 364 p

Avail: Univ. Microfilms: HC $16.45/Microfilm $4.65 Order No. 69-4179

A new isothermal titration calorimeter was designed to facilitate the study of heats of reaction and heats of solution at constant temperature. With this calorimeter, endothermic or exothermic processes can be studied at temperatures constant to + or − 0.0002°C. Heat effects are compensated by balancing the heat effect of the process taking place in the calorimeter against a variable heat and a constant cooling Peltier device. The

calorimeter was tested by measuring the heat of ionization of water and the heat of dilution of aqueous hypochlorite solutions. For these systems heats were measured to an accuracy of + or − 0.02 calorie. The results were compared to electrostatic predictions and it was found that electrostatic considerations do not predict the metal-ligand behavior in solution. They indicate that solvent effects for the various metal complexes are similar and that the temperature dependence of the thermodynamics of the metal glycinate complexes are similar for each of the metal glycinate systems.
Dissert. Abstr.

N70-10516 National Lending Library for Science and Technology, Boston Spa (England).
ELECTRON-MICROSCOPIC INVESTIGATIONS OF THE STRUCTURAL CHANGES IN COLLAGEN AS A RESULT OF ALKALI-SALT TREATMENT [ELEKTRONNOMIKROSKOPICHESKIE ISSLEDOVANIYA IZMENENII STRUKTURY KOLLAGENA V REZULTATATE SHCHELOCHNO-SOLEVOI OBRABOTKI]
O. O. Babloyan et al Jul. 1969 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Tekhnol. Legkoi Prom. (USSR), no. 4, 1966 p 92–96
(NLL-RTS-5260) Avail: Natl. Lending Library, Boston Spa, Engl.: 12s 6d

The influence of NaOH solutions in the presence of Na2SO4 on the structure of collagen does not differ substantially from that of lime solutions. However, the high concentration of hydroxyl ions in the solution of caustic soda as compared with the lime solution causes a more rapid disaggregation of the collagen structure, with breakdown of the inter- and intramolecular bonds. The latter circumstance causes easy fusibility of gelatin and leads to complete solubility of the dermis of longhorned cattle at a temperature of 291 to 293 K. R.B.

N70-10519 National Lending Library for Science and Technology, Boston Spa (England).
OXIDATION AND DIMERIZATION OF STYRENE AND METHYLSTYRENE BY VARIOUS PALLADOUS SALTS [KAHUSHU PARA JIUMU (2) EN NI YORU SUCHIREN OBOBI MECHIRUSUCHIREN NO SANKA TO SANKATEKI SHUKUGO]
S. Uemura et al Jun. 1969 12 p refs Transl. into ENGLISH from Nippon Kagaku Zasshi (Tokyo), v. 89, no. 7, 1968 p 692–694
(NLL-RTS-5111) Avail: Natl. Lending Library, Boston Spa, Engl.: 7s 6d

As a result of reactions of various palladous salts with styrene and methyl styrene in an acetic acid solvent, both an oxidation reaction forming enol ester, allyl ester, and ketone and also a dimerization reaction forming butadiene derivatives occur, the proportion being determined mainly by the type of palladium salt. In reactions with the acetate, the main substances formed are alpha and beta acetoxystyrene and 1,4-diphenyl butadience from styrene, 2-phenylallyl acetate and 2,5-diphenyl1-2,4-hexadiene from alpha methyl styrene, and 3-phenyl allyl acetate from beta methyl styrene. With the nitrate there was considerable formation of ketone, and with the sulfate a dimer olefin compound was the main product. In the presence of sodium acetate the reaction between the acetate and the chloride and styrene produced rather more enol ester than condensation product. Author

N70-10521 National Lending Library for Science and Technology, Boston Spa (England).
AN EXAMINATION OF THE INFLUENCE OF ORGANIC ANTI-FOG SUBSTANCES ON DEVELOPING PROCESSES [ISSLEDOVANIE VLIYANIYA ORGANICHESKIKH ANTIVUALIRUYUSHCHIKH NA PROTSESS PROYAVLENIYA]
G. P. Faerman Jul. 1969 19 p refs Transl. into ENGLISH from Usp. Nauchn. Fotogr. (Moscow), v. 13, 1968 p 142–150
(NLL-RTS-5130) Avail: Natl. Lending Library, Boston Spa, Engl.: 22s 6d

The antifog effect of potassium bromide in the developing process is presented as the mechaniam for fog reduction as a result of the reaction of the developer with silver ions. The introduction of some weak organic acids or amphlytes into the developer composition for fog reduction is presented, and the effect of the pH of the solution on the silver ion concentration in the saturated solution is discussed. F.O.S.

N70-10540 Yale Univ., New Haven, Conn.
THE THERMODYNAMICS OF THE CONFORMATIONAL TRANSITIONS OF THE POLY A-POLY U COMPLEXES
Henry Krakauer (Ph.D. Thesis) 1968 177 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-8377

The thermodynamic characterization of the conformational transitions of the Poly A-Poly U complexes was achieved through the study of the effect of the cations Na(+) and K(+) on the transitions. They can be written in the generalized from A yields B + iM +. This states that the transitions are intramolecular, form A of the polynucleotide going to form B, and that they are accompanied, in effect, by the increase of i moles of counterion, M+ = Na+ or K+, per mole of A = base pairs (A+U) or triplets (A+2U), depending on the transition. More strictly, it is implied that the chemical potential of the counterion is an additive term in the deltaG for the transitions. An approach to the influence of Mg++ on the transitions using the above concepts is outlined.
Dissert. Abstr.

N70-10546# National Research Council of Canada, Ottawa (Ontario).
CROSS-LINKING OF A DIGLYCIDYL ETHER OF BISPHENOL-A WITH PHTHALIC ANHYDRIDE BY PRE-ACTIVATION OF THE RESIN WITH 1,1 DIMETHYL UREA
P. D. McLean (Natl. Aeron. Estab., Ottawa) May 1969 27 p refs
(NRC-10859; MS-123) Avail: CFSTI

Urea and its compounds heated with epoxy resins produce a reactive and toxic composition that can open the ring of the phthalic anhydrides and thereby facilitate union of the carboxyl with the epide and subsequent hydroxyl groups. Disubstituents of low molecular weight on the same nitrogen atom of urea have the highest reactivity. The quantity of activator required to crosslink the anhydride with the epide resin is of the order of parts per million. Optimum conditions of time and temperature and a range of concentrations of the urea compound can be selected to produce an activated epoxy resin. Optimum ratios of phthalic anhydride to activated resin are also available for selection in making the thermosetting plastic. Author

N70-10564 Utah Univ., Salt Lake City.
STUDIES OF AMMONIUM PERCHLORATE-BASED PROPELLANT IGNITION BY LOW CONVECTIVE HEAT FLUXES
Charles Peter Richardson (Ph.D. Thesis) 1968 174 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-1778

Vapor-liquid equilibrium measurements were carried out on the acetonechloroform-methanol system at 50 C. using an improved vapor-recirculation-type still. The complete range of concentrations was investigated, including the constituent binary systems. Chemical methods were used for analysis, supplemented by density and refractive index measurements. Results are presented in the form of activity coefficients, gamma, as a function of various concentrations. Binary and ternary constants for the three-suffic

Margules equations were determined by plots of log gamma/(1-x) to the second power as a function of the mole fraction, x. The three-suffic Margules equations were found to represent both the binary and the ternary data adequately. Using a new form of the three-suffic Margules equation, it was possible to predict ternary conditions approximately from binary data alone. Based on equations of the Margules type, a general procedure was outlined for determining binary constants rapidly and for predicting ternary relations from these alone in simple cases. Dissert. Abstr.

N70-10565 Purdue Univ., Lafayette, Ind.
THE DITHIOLATE LIGAND IN BORON COMPOUNDS OF UNUSUAL OXIDATION STATE
Richard Frank Gold (Ph.D. Thesis) 1968 121 p refs
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-7446

A series of new boron-sulfur compounds was prepared. When toluene 3,4-dithiol is treated with boron trichloride, 2 chloro 6 methyl 1,3,2 dithiabenzoborolane results. Similarly, 2 chloro 1,3,2 dithiabenzoborolane results from the reaction between benzene 1,2 dithiol and boron trichloride. Treatment of these borolanes with 2,2' bipyridine results in the formation of the corresponding boronium chloride salts. Reduction of these boronium salts with finely divided lithium results in the formation of neutral, spiro compounds. A study of these odd-electron molecules employing electron spin resonance indicates that the odd electron spends considerably more time on the bipyridine ligand than on the dithiol ligand. Symmetric bis(dithiolate)borates result from the reactions between toluene 3,4 dithiol and benzene 1,2 dithiol with lithium borohydride, and are obtained in nearly quantitative yield. The reaction of 2,2' bipyridine with boron trichloride results in the formation of a 1:2 complex whose structure is discussed. Dissert. Abstr.

N70-10567# Naval Postgraduate School, Monterey, Calif.
TEMPERATURE DEPENDENCE OF THE ELECTRON SPIN RESONANCE SPECTRUM OF THE NEGATIVE CH2CO2(-) RADIAL RADICAL FORMED IN X-IRRADIATED ZINC ACETATE DIHYDRATE
John Woodrow Hunt (M.S. Thesis) Jun. 1969 134 p
(AD-692455) Avail: CFSTI CSCL 7/4

A decrease of one to six gauss (depending on magnetic field orientation) in the coupling constants of the CH2CO2(-) radical formed in X-irradiated zinc acetate dihydrate has been observed over a temperature range of about -60C to +30C. Calculations of dipolar and Fermi contact interaction based on a model of internal rotation of the methylene group about the C-C bond have shown a small coupling constant decrease on the order of 0.19 gauss over a temperature range of -150C to +90C. The major effect has been shown to be due to a spin relaxation mechanism. The effect was calculated using Monte Carlo techniques, the results of which were confirmed by experimental data. Author (TAB)

N70-10575*# California Univ., Santa Cruz. Div. of Natural Sciences.
GEOMETRICAL INFLUENCES ON NON-RADIATIVE PROCESSES IN ORGANIC MOLECULES Progress Report
Earl M. Evleth Jul. 1969 35 p refs
(Grant NGR-05-061-004)
(NASA-CR-106639) Avail: CFSTI CSCL 07D

The ground and excited state of energies of planar and distorted configurations of organic molecules are calculated. A semiemperical method is used for the ground state. It is shown that for the excited states, the results are dependent on the assumed changes in the geometry, and that most of the stabilization of the excited state twisted configuration comes from the assumed increase in C-C bond distance. Quantum mechanically based rules for thermal and photochemical reactions; and photophysical and photochemical studies in aryldiazonium cations are presented. F.O.S.

N70-10593# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
PLASMA ARC ALLOY ANALYSIS USING ULTRASONIC NEBULIZATION Technical Report, Jan. – Dec. 1968
James H. Muntz Jun. 1969 25 p refs
(AD-692104; AFML-TR-68-387) Avail: CFSTI CSCL 14/2

An ultrasonic nebulizing-plasma arc system has been under evaluation. The nebulizing unit consists of a focused piezoelectric transducer operating at 1.4 megahertz, which creates a fine uniform aerosol from solutions held in a chamber. Acoustical energy is water coupled to this chamber through a thin plastic film. The systems main advantage is the handling of concentrated solutions. Both cation and anion matrix effects were found, but with adequate matching of standards and samples, both accuracy and precision for high temperature alloy analysis can be within plus or minus 5%. Author (TAB)

N70-10602*# Techtran Corp., Glen Burnie, Md.
CHROMATOGRAPHY OF PEPTIDES
Yoshito Yaoi (Osaka Univ.) et al Washington, D.C. NASA Oct. 1969 22 p refs Transl. into ENGLISH from Kagaku no Ryoiki, Zokan (Tokyo), v. 63, 1964 p 135-154
(Contract NASw-1695)
(NASA-TT-F-12660) Avail: CFSTI CSCL 07C

Recent developments in ion exchange chromatography of peptides obtained by partial decomposition of protein, with special attention to methods using volatile buffer solutions, are summarized. Author

N70-10625# Notre Dame Univ., Ind. Radiation Lab.
BIBLIOGRAPHY ON THE RADIATION CHEMISTRY OF ALCOHOLS AND PHENOLS
6 Nov. 1968 37 p refs
(Contract AT(11-1)-38)
(COO-38-643) Avail: CFSTI

References covering the literature from 1953 to 1968 are presented in categories (aliphatic alcohols, other alcohols, phenols, and catalytic processes in alcohols) by serial number, which is approximately chronological. Author and compound indexes are included. NSA

N70-10633# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
THE VAPOR PRESSURE OF STANDARD SAMPLES OF GOLD AND SILVER Technical Report, Nov. 1967 – Sep. 1968
Gerard L. Haury Jun. 1969 42 p refs
(AD-692103; AFML-TR-68-368) Avail: CFSTI CSCL 7/4

The vapor pressures of gold and silver were measured by the Knudsen effusion technique. Vapor pressures were determined for liquid gold in the temperature range 1700 to 2000K. Vapor pressures were determined for liquid silver in the temperature range 1370 to 1525K. TAB

N70-10635# Air Force Systems Command, Edwards AFB, Calif. Rocket Propulsion Lab.
DECOMPOSITION KINETICS OF CHLORINE TRIFLUORIDE AND CHLORINE PENTAFLUORIDE Final Report May 1968 – Jan. 1969
Jay A. Blauer, Henry G. Mc Math, Frederic C. Jaye, and Victor S. Engleman Jun. 1969 58 p refs
(AD-692493; AFRPL-TR-69-144) Avail: CFSTI CSCL 7/4

The thermal dissociations of ClF3 and ClF5 behind incident shock waves have been studied in the temperature range of 800 to 1300K. The courses of these dissociations were followed by monitoring the optical densities of the reacting mixes at 2200A. Plausible mechanisms are postulated for the overall decompositions and these are compared to the experimental results by means of a non-equilibrium computer program which treats the two sets of

data as representative of isentropically reacting systems. The unimolecular decomposition rate constants are interpreted in terms of the latest statistical theory of reaction rates and the results are discussed. Author (TAB)

N70-10636# Air Force Systems Command, Edwards AFB, Calif. Rocket Propulsion Lab.

MASS THERMAL ANALYSIS OF HYDROXYLAMINE AND METHOXYAMINE PERCHLORATES Final Report, Oct. 1968 – Apr. 1969

Berge B. Goshgarian May 1969 23 p refs

(AD-692492; AFRPL-TR-69-118) Avail: CFSTI CSCL 7/2

Mass thermal analysis was used to study the thermal decomposition of hydroxylamine and methoxyamine perchlorates. The first step in the thermal decomposition of these salts is the proton transfer from the substituted ammonium ion to the perchlorate anion to form the free substituted amine and perchloric acid. Activation energies were determined to be 20.7 kcal/mole (65 to 77C) for the dissociation of hydroxylamine perchlorate, and 30 kcal/mole (53 to 77C) for the dissociation of methoxyamine perchlorate. Author (TAB)

N70-10637 National Lending Library for Science and Technology, Boston Spa (England).

SYNTHESIS OF BUTYLPHENOL FORMALDEHYDE RESIN IN AN ANHYDROUS MEDIUM [SINTEZ BUTILFENOLO-FORMAL'DEGIDNOI SMOLY V BEZVODNOI SREDE]

M. I. Arkhipov et al May 1969 12 p refs Transl. into ENGLISH from Lakokrasochnye Materialy i Ikh Primenenie (USSR), v. 2, 1968 p 1–4

(NLL-RTS-5159) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s

Butylphenol formaldehyde resin was synthesized by heating, in a glycerine bath para tert. butylphenol (PTBPH) paraform and an accelerator (catalyst). The resin formed at 60 to 75°C with the accelerator hexamethylene tetramine. Tables showing the effect of PTBPH and CH_2O ratio on synthesis time, and resin composition and properties are included. F.O.S.

N70-10654# Technische Hochschule Munchen (West Germany). Fakultat fuer Allgemeine Wissenschaften.

THE PHENACYL GROUP AS FUNCTIONAL GROUP ON SOLIDS AND IN THE URETHANE PROTECTIVE GROUP IN PEPTIDE SYNTHESES, AND PREPARATION OF THE 2,2,2-TRIFLUOR-1-ETHYL-MERCAPTO-ETHYL-ISOCYANATE [DIE PHENACYLGRUPPE ALS FUNKTIONELLE GRUPPE AM FESTKOERPER UND IN DER URETHANSCHUTZGRUPPE BEI PEPTIDSYNTHESEN SOWIE DARSTELLUNG DES 2.2.2-TRIFLUOR-1-AETHYLMERCAPTO-AETHYL-ISOCYANATS]

Helmut Hintermaier (Ph.D. Thesis) 1969 56 p refs In GERMAN Avail: CFSTI

The phenacyl group was utilized as new urethane protection group for the amino function in peptide synthesis as well as in a ketone protective and free form by introduction over the acid chloride analog to the carbobenzoxy group. The acid chloride was solid and stable at 0 C. The keton protected group can be separated by aqueous trifluoracetic acid; obtained N-protected amino acid derivatives crystallize out and can be separated by mild nucleophilic reagents. It was shown experimentally that N-protected dipeptide can be bound by phenacylester to a polymer. Synthesis of 2.2.2-trifluoro-1-ethyl-mercapto-ethyl-isocyanate made is possible to obtain urethane and urea compounds through reactions with alcohols and amines. Transl. by G.G.

N70-10689*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

CLASSICAL THEORY OF DENSITY CORRECTIONS TO THE GASEOUS TRANSPORT COEFFICIENTS OF MIXTURES

David Ellwyn Bennett, III (Ph.D. Thesis) 20 Dec. 1968 99 p refs

(Grant NGL-50-002-001)

(NASA-CR-106656; WIS-TCI-330) Avail: CFSTI CSCL 07D

A modified Boltzmann equation for mixtures is developed which includes the effects of collisional transfer and three particle collisions. This equation is then solved by perturbation expansion techniques. General expressions for the fluxes are derived with the resulting transport coefficients expressed in terms of the perturbation coefficients. Finally, the various integrals encountered in the development are evaluated numerically. Author

N70-10693 National Lending Library for Science and Technology, Boston Spa (England).

CALCULATION OF THE EQUILIBRIUM CONSTANT OF THE REVERSIBLE REACTION NITROGEN TETROXIDE YIELDS 2 NITROGEN PEROXIDE ON THE BASIS OF THE MOLECULAR CONSTANTS OF THE COMPONENTS [RASCHET KONSTANTY RAVNOVESIYA REAKTSII N SUB 2 O SUB 4 YIELDS 2 NO SUB 2 NA OSNOVANII MOLEKULYARNYKH POSTOYANNYKH KOMPONENT]

L. V. Mishina et al [1969] 13 p refs Transl. into ENGLISH from Vestsi Akad. Navuk Belarusk. SSR (Belorussk), no. 4, 1967 p 23–28

(NLL-RTS-5226) Avail: Natl. Lending Library, Boston Spa, Engl.: 15s

Experimental and calculated values of the equilibrium constant for the reversible nitrogen tetroxide–nitrogen peroxide reaction were reviewed. Molecular data were determined on the frequency oscillations and freedom of rotation with assumed data on the electronic levels of the N_2O_4 molecule in order to develop a model of the molecule in the ideal gas state. An approximation polynomial based on molecular constants is used to calculate the equilibrium constant of the reaction; the result is in good agreement with other experimental and mathematical methods and produces coefficients with an accuracy of 0.3%. M.H.E.

N70-10694# Ballistic Research Labs., Aberdeen Proving Ground, Md.

HYDRATED POSITIVE IONS IN NITRIC OXIDE-WATER AFTERGLOWS

William C. Lineberger and Lawrence J. Puckett Jul. 1969 28 p refs

(AD-692307; BRL-1443) Avail: CFSTI CSCL 4/1

Results of measurements performed on a stationary NO-H_2O afterglow are reported in this paper. The gas mixture was contained in a large, gold-plated, cylindrical chamber in which the NO was ionized by means of krypton resonance radiation. The ions from the afterglow were sampled through an electrically insulated orifice and were quantitatively detected by time-resolved mass spectrometry. For $NO(+)$ ions reacting in NO-H_2O mixtures at 293 K, the product ion mass spectrum is dominated by $NO(+)$ and its hydrates, $NO(+).nH_2O$, and by hydrated-hydronium $H_3O(+).nH_2O$. The sequence of reactions leading to these products has been determined, and the rate constant for the three-body conversion of $NO(+)$ to $NO(+).H_2O$ has been measured. Bounds for several other rate constants in the reaction sequence have been obtained. The ions $H_3O(+).2H_2O$, $H_3O(+).3H_2O$, and $H_3O(+).4H_2O$ observed in the afterglow are of the same family as the hydronium ion $H_3O(+)$ and its hydrates $H_3O(+).H_2O$ and $H_3O(+).2H_2O$, which are prominent in the D-region of the ionosphere. Reaction sequences similar to the one reported in this paper, which involve multiply hydrated atmospheric ions, may be an important contributor to the production of the hydrated-hydronium observed in the ionosphere. Author (TAB)

N70-10709*# Stanford Research Inst., Menlo Park, Calif.
BINDER MODEL SYSTEM TO BE USED FOR DETERMINATION OF PREPOLYMER FUNCTIONALITY
Quarterly Report, 19 Feb.–19 May 1969
J. H. Hodgkin, F. J. Martinelli, and J. Heller 17 Jun. 1969 10 p refs Prepared for JPL
(Contract NAS7-689; SRI Proj. PRU-7471)
(NASA-CR-106645; QR-3) Avail: CFSTI CSCL 07B

The recording viscometer method to determine the functionality of prepolymers used for rocket binders was further improved and modified. The method was applied to the reactions of model compounds, and the results obtained correspond closely with the expected values at Rho < 0.5. Above Rho = 0.5 the results were erratic due most probably to steric hindrance in the highly branched chains formed where large amounts of trifunctional material was present. Author

N70-10712*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
A RESONANCE THEORY OF THERMOLECULAR RECOMBINATION KINETICS: H + H + M YIELDS H2 + M
Robert Earl Roberts 13 Aug. 1968 182 p refs
(Grants NsG-275-62; NSF-GP-7409)
(NASA-CR-106655; WIS-TCI-306) Avail: CFSTI CSCL 07D

A theory is formulated for atomic recombination reactions which is based upon the identification of the set of transition complexes as specific quasibound states or orbiting resonances. The conventional energy transfer mechanism is assumed, since it has been justified under many experimental situations. Calculations, based on a modified distorted wave approximation, demonstrate that the main contribution to the rate arises from rotational rather than vibrational transitions downwards from the quasibound to the bound states. Computations were carried out for the reaction H + H + M yields H2 + M for M equaling helium, hydrogen, and argon making use of the spectrum of quasibound states and their wave functions. Good agreement is found between the experimental rate constant and that calculated by the present resonance theory. The theory predicts low temperature behavior which is attributed to a particular quasibound state and thus provides a promising region for further experimental investigation. Author

N70-10716 National Lending Library for Science and Technology, Boston Spa (England).
THE EFFECT OF HEAT TREATMENT ON THE QUALITY OF HALOPHOSPHATE PHOSPHORS [O VLIYANII TERMOOBRABOTKI NA KACHESTVO GALOFOSFATNYKH LUMINOFOROV]
E. M. Gurevich Aug. 1969 12 p refs Transl. into ENGLISH from Svetotekhnika, No. 6, 1968 p 7–10
(NLL-RTS-5271) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s

During manufacture of fluorescent lamps, loss of brightness is related to baking out the binder and pumping down the lamps during vacuum. It is concluded that loss of brightness of the phosphors during heat treatment at temperatures which ensure complete burning out of the binder are not due to the presence of the binder itself, but is a function of the degree of fineness of the phosphor. Darkening of the phosphor and reduction in brightness at the baking-out temperature (500 to 550 deg C) of the binder is due to precipitation of free antimony onto the surface of the phosphor particles. Brightness of the phosphor can be restored by subsequent heating at 900 deg C, which removes the free antimony in the binder, although restoration of brightness is dependent on phosphor grain size. Comparison of phosphors produced in different countries indicates that loss of brightness is in proportion to the content of free antimony in them. R.B.

N70-10727 National Lending Library for Science and Technology, Boston Spa (England).
THE INFLUENCE OF SUPERMOLECULAR STRUCTURE ON THE DYNAMIC-MECHANICAL PROPERTIES OF POLYPROPYLENE [VLIYANIE NADMOLEKULYARNYKH STRUKTUR NA DI NAMICHESKIE MEKHANICHESKIE SVOISTVA POLIPROPIENA]
G. M. Barmenov et al Jun. 1969 10 p refs Transl. into ENGLISH from Vysokomolekul. Soedin. (Moscow), pt. B, v. 10, no. 7B, 1968 p 504–507
(NLL-RTS-5209) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s

Simultaneous direct optical and X-ray diffraction methods were used to observe the mechanical relaxation process and structural modification in polypropylene. Thermal treatments of the polypropylene gave samples with different supermolecular structures. Forced mechanical vibrations applied to each sample in a varying mechanical field resulted in a maximum of mechanical losses; the losses were believed to be connected with the mobility of the structural elements of the supermolecular formations. A link was established between the temperature position of this maximum and the conditions of crystallization of the sample. M.H.E.

N70-10729 National Lending Library for Science and Technology, Boston Spa (England).
CHEMICAL MODIFICATION OF CARBON BLACK
S. Glowka et al 18 Mar. 1969 8 p refs Transl. into ENGLISH from Polimery (Warsaw), No. 12, 1967 p 571–573
(NLL-M-7642-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Surface-active properties and the chemical modification of carbon black by heat treatment and ionizing radiation were investigated. Six multifunctional compounds were used: (1) N-nitrosomethylaniline; (2) dioxynitrosobenzoquinone; (3)pentachlorothiophenol; (4) hexachlorocyclopentadiene; (5) 2,6-dichloro-4-nitrophenol; (6) tetrachloroquinone. The chemica interaction between carbon black and polymer, the degree of cross-linking of vulcanizates, and the electrical conductivity were measured. The experiments show that the increase in the modulus of vulcanizates filled with carbon black modified by hexachlorocyclopentadiene and pentachlorothiophenol is due to an increase in the surface activity of the carbon black and in the physical interaction with rubber. Agreement with recent investigations and the practical importance of filler modification are demonstrated. M.H.E.

N70-10732# Explosives Research and Development Establishment, Waltham Abbey (England).
THE PREPARATION OF SOME BIS-(BETA-DIKETONES)
J. A. Bell 12 Mar. 1969 19 p refs
(AD-692054; ERDE-3/M/69) Avail: CFSTI CSCL 7/3

Bis-(beta-diketones) have been prepared by reaction between a methyl ketone and an ester, an acid chloride, or a dibromo paraffin in the presence of a basic condensing agent. Methods available for preparing some related compounds are listed. Author (TAB)

N70-10764# Newcastle Univ. (England). Dept. of Organic Chemistry.
ORGANIC RADIATION CHEMISTRY Final Report, Oct. 1964–Apr. 1969
G. A. Swan and J. M. Fayadh May 1969 38 p refs
(Contract AF 61(052)-773)
(AD-692106; AFML-TR-69-137) Avail: CFSTI CSCL 7/5

Gamma-radiolysis of pure NN-dimethylaniline yields NN-dimethyl-NN-diphenylethylenediamine (through dimerisation of the N-methylanilinomethyl radical) together with hydrogen, methane, and N-methylaniline; but when the radiolysis is carried out in the

presence of acid the first named product is replaced by N-p-dimethylaminobenzyl-N-methylaniline and/or 4,4-bisdimethylaminodiphenylmethane, formed via the ion (PhNMe:CH2) +. The two latter products are also formed by photolysis of the amine in the presence of acid. Gamma-radiolysis of NN-dimethyl-p-toluidine gives NN-dimethyl-NN-di-p-tolylethylenediamine and 4,4-bisdimethylaminobibenzyl. Gamma-irradiation or photolysis of NN-dimethylaniline in the presence of N-phenylmaleimide yields 1,2,3,4-tetrahydro-1-methylquinoline-3,4-dicarboxylic-N-phenylimide, through a radical reaction. A similar reaction occurs with other NN-dialkylanilines, N-phenylpyrrolidine, or N-phenylpiperidine in the presence of olefinic compounds such as N-phenylmaleimide, diethyl maleate, cyclohexene, or cyclopentene. Author (TAB)

N70-10775# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.

NUCLEAR RESONANCE STUDIES ON PARAMAGNETIC TRANSITION METAL COMPLEXES [KERNRESONANZUNTERSUCHUNGEN AN PARAMAGNETISCHEN UEBERGANGSMETALLKOMPLEXEN]

Walter Gretner (Ph.D. Thesis) 1969 92 p refs In GERMAN
Avail: CFSTI

Chemical shifts in paramagnetic transition metal complexes are studied by comparing ^{1}H- and ^{14}N nuclear magnetic resonance spectra of similar compounds with identical ligands but differing metal centers for their spin transfer mechanisms. Systematic studies on dipyridine adducts of bis(salicylaldehydato) iron(II), cobalt(II), and nickel(II) complexes showed that: (1) transfer on non-paired spin density from the central metal to the ligand system took place either through the pi-bonds in salicylaldehyde rings or through the sigma-bonds in transfer of pyridine- or picoline protons. These differences are attributed to variations in wave functions of the ligand molecules. Studies on tetrabutylammonia salts of tetradic anion complexes of cobalt and nickel showed that the hetero nuclei of the cations (^{14}N, ^{31}P) reacted in direct exchange with the central metal atom of the anion and thus transferred positive spin density to the nitrogen resp. phosphorus. Transl. by G.G.

N70-10784# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Chemistry and Chemical Engineering.

THE SYNTHESIS AND MECHANISM OF THERMAL DEGRADATION OF SOME DIKETONE: DIAMINE POLYMERS

L. G. Kaufman, P. T. Funke, and A. A. Volpe 12 Aug. 1969 20 p refs
(Contract N00014-68-A-0131)
(AD-692478; TR-11; ONR-356-491) Avail: CFSTI CSCL 11/9

Three polymers were synthesized by the acid catalyzed polycondensation of m-dibenzoylbenzene with ethylenediamine, and by the polycondensation of p-dibenzoylbenzene with tetrafluoro-m-phenylenediamine and tetrafluoro-p-phenylenediamine. The thermal stability of these polymers was determined by thermogravimetric analysis in air and in an inert atmosphere. In addition, three isomeric polymers which were synthesized in a previous investigation by the polycondensation of m-dibenzoylbenzene with o-, m-, and p-phenylenediamine were subjected to combined thermogravimetric analysis (TGA) - vapor phase chromatography (VPC) -- mass spectral analysis (MS). By means of this combined analysis, it was possible to thermally degrade a polymer sample, collect the condensable products given off upon thermal degradation, separate the products by vapor phase chromatography, and identify them by mass spectroscopy. Upon identification of the fragments given off, it was possible to characterize the mechanism or mechanisms of thermal degradation of these polymers. Author (TAB)

N70-10787# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.

ASYMMETRICAL PEPTIDE SYNTHESIS AND REDUCTION-SEPARATION OF N-TRIFLUORO-ACETYL COMPOUNDS WITH SODIUM BORHYDRIDE [ASYMMETRISCHE PEPTIDSYNTHESEN SOWIE REDUKTIVE ABSPALTUNG DER N-TRIFLUOR-ACETYLGRUPPE MIT NATRIUMBORHYDRID]

Erich Frauendorfer (Ph.D. Thesis) 1969 88 p refs In GERMAN
Avail: CFSTI

Induction parameters were determined for the synthesis of N-benzoyl-dipeptide esters from racemic oxazolones-(5) and optic active amino acid esters. Reaction parameters were calculated from diastereomeric proportions and chirality parameters of amino acid esters for the individual oxazolone-(5) compounds. Reaction of 2-trifluoromethyl-4-tertiar butyl-pseudooxazolone(5) with L-glu(OCH$_3$)$_2$ gave 86% of the LL-diastereoisomer. It was found that the trifluoroacetyl- and the trichloracetyl group of N-Tfa- and N-TCla-peptides could be quantitatively separated by sodium borhydride. Transl. by G.B.

N70-10820# General Research Corp., Santa Barbara, Calif.

ON THE TEMPERATURE-DEPENDENCE OF THE DISSOCIATIVE RECOMBINATION RATE

T. F. O'Malley Apr. 1969 13 p refs
(Contract DAAH01-69-C-0841; ARPA Order 958)
(AD-692319; TM-1054) Avail: CFSTI CSCL 7/4

Models are considered and formulas deduced for the dependence of the dissociative recombination rate on vibrational temperature Tv and electronic temperature Te. Author (TAB)

N70-10831# Atomic Energy Centre, Dacca (Pakistan).

EXTRACTION OF ZIRCONIUM WITH MIXED SOLVENTS FROM NITRIC ACID SOLUTIONS

M. A. Awwal, K. M. Idriss, and S. Masum Ali Aug. 1968 23 p refs
(AECD/CH-12) Avail: AEC Depository Libraries

The extraction of Zr with four pairs of solvents such as trioctylphosphine oxide (TOPO) -thenoyltrifluoroacetone (TTA), TOPO-Primene JMT (PrJMT), tributyl phosphate (TBP)-TTA, and TBP-PrJMT has been investigated as a function of different extraction parameters. The distribution coefficient of zirconium has been studied with individual solvent as a function of nitric acid concentration and also with mixed pairs of solvents. Finally, the extractions of zirconium as a function of mixed solvent concentration have been studied from constant aqueous phase acid. Synergistic and antisynergistic extraction effects were observed. Mechanisms of extraction are explained for the solvation and adduct formation. Author (NSA)

N70-10873# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.

REFRACTIVE INDEX OF LIQUID DEUTERIUM

C. E. Childs and D. E. Diller [1969] 11 p refs Presented at Cryog. Eng. Conf., Los Angeles, 16-18 Jun. 1969
Avail: CFSTI

A method for computing accurate refractive index values for saturated liquid ortho-deutrium is described. A table of refractive index values at three wavelengths (3200, 5461, and 6328 A) and at temperatures between 18.7 and 30.0 K is presented. The uncertainty of the results is estimated to be less than 1.0% in the specific refraction or 0.1% in the refractive index. Author

N70-10887# Akademiya Nauk URSR, Kiev.

THE HYDRODYNAMICS OF A BOILING LAYER OF CAPRONE RESIN GRANULES

L. M. Mishnayevskiy and N. A. Sharkova *In its* Processes of Combust. and Heat Treat. of Mater. 1967 p 77-85 refs In RUSSIAN (See N70-10876 01-33)
Avail: CFSTI

The pseudo-liquefaction rate of granulated polycaprolactam is not dependent on the height of the layer and may be assumed to be equal to 1.1 to 1.5 m/sec, depending on particle diameter. The shape of the heating chamber has a negligible effect on rate of operation, although an improvement in mixing of the material is noted upon switching from a circular to a segmented chamber. The hydraulic pressure of the pseudo-liquified layer depends only on the height of the layer present per unit of lattice area. Recommended active cross-section for the gas-distributing lattice providing acceptable hydraulic drag and good mixing of the granules during boiling is within the range of 5 to 10%. When the immobile layer is a certain height, a boiling layer is obtained which is suitable for evaporation of low-molecular compounds and moisture from the polymer. Most feasible is a process with a fine fraction, which provides good mixing of the layer and reduction of pressure and gas consumption. Transl. by R.B.

N70-10897 National Lending Library for Science and Technology, Boston Spa (England).
THE FEASIBILITY OF COMBINING VARIOUS ELECTROCHEMICAL SYNTHETIC REACTIONS [O VOZMOZHNOSTI SOVMESHCHENIYA NEKOTORYKH REAKTSII ELEKTROKHIMICHESKOGO SINTEZA]
M. Ya. Fioshin Jul. 1969 16 p refs Transl. into ENGLISH from Khim. Prom. (Moscow), v. 44, 1968 p 882–885
(NLL-RTS-5178) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s

Simultaneous electrosyntheses of hydroxylamine and ammonium persulfate were obtained in one electrolytic cell with diaphragm by reducing the nitric acid to hydroxylamine at the mercury cathode and by oxidizing ammonium sulfate on the platinum anode to ammonium persulfate. Similar syntheses of both inorganic and organic compounds were also described for p-aminophenol and ammonium persulfate, nicotinic acid and N-acetyl-1,2,3,4,-tetrahydroquinoline, as well as electrochemical chlorination of organic compounds at the anode with simultaneous preparation of alkali in the cathode department as exemplified on the methane —methyl chloride system. Electrosynthesis of heat stable fluorinated hydrocarbons was accomplished by molten salt electrolysis; fluorinated hydrocarbons were formed as a result of participation in the reaction of the carbon from a graphite or carbon electrode. G.G.

N70-10970# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
BIBLIOGRAPHICAL REVIEW. STRUCTURE OF LIQUID WATER: WORK RELATING TO THE PREPARATION AND STUDY OF WATER OF MODIFIED STRUCTURE [ETUDE BIBLIOGRAPHIQUE. STRUCTURE DE L'EAU LIQUIDE: TRAVAUX RELATIFS A L'OBTENTION ET A L'ETUDE D'UNE EAU A STRUCTURE MODIFIEE]
Lucien Gilles Jun. 1969 61 p refs In FRENCH; ENGLISH summary
(CEA-BIB-151) Avail: CFSTI

1) Structure of liquid water: The information obtained from physico-chemical properties and analytical methods is not sufficient for establishing an exact model of the structure of liquid water. Several theories have been proposed which may be classified in three groups a) Theories based on an ice structure which deforms on melting, and whose interstices are partially filled with water molecules. b) Theories based on the simultaneous existence of two states each having its own structure. c) Theories based on the simultaneous existence of 'free' water molecules and fluctuation clusters formed from water molecules linked together. This model, proposed by Franck and Wen and developed by Nemethy and Scheraga, appears consistent with numerous observations. 2) Work designed to produce and to study water having a modified structure: Deryagin interprets the modifications in the mechanical properties of films and polar liquids as being due to a structural change brought about by the solid with which they are in contact. This transformation also occurs when these liquids are condensed in silica capillaries having a radius of less than 30 microns, at a pressure below their saturated vapour pressure. The liquid thus obtained has new properties which have been studied in detail in water. Density and viscosity measurements seem to indicate that the 'modified water' structure is more compact than that of normal water. Deryagin has put forward the hypothesis that the structure consists of stable associations of water molecules (dimers or trimers). The association of these molecules could occur at the silica surface, and could be due to the condensation of dimers or trimers existing in the vapour phase. Erlander believes that the structure could be made up of groups of molecules held together by hydrogen bonds similar to those existing in ice II (rhombohedric structure). Author (ESRO)

N70-10979# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
REACTIONS OF ALKENES WITH COBALT CARBONYLS [REACTIONS DES ALCENES AVEC LES COBALT CARBONYLES]
René Ramasseul (Ph.D. Thesis) Jun. 1969 25 p refs In FRENCH; ENGLISH summary
(CEA-BIB-150) Avail: CFSTI

Cobalt carbonyls are particularly active catalysts for several organic reactions and have been put to use in industrial synthesis. The present work is concerned with the reactions of alkenes with cobalt carbonyls namely: 1) substitution reactions of dicobalt octacarbonyl; 2) by alkenes, cobalt hydrocarbonyl addition on alkenes and related reactions; 3) alkyl and acylcobalt tetracarbonyls addition on alkenes; 4) hydrogenation, isomerization and polymerization of alkenes in the presence of cobalt carbonyls. Author (ESRO)

N70-10990# Naval Ship Research and Development Center, Annapolis, Md. Materials Lab.
APPLICATION OF A THEORY OF BINARY SOLUTION SURFACE TENSION TO INTERFACIAL TENSION PHENOMENA
Donald J. Cotton Washington Jul. 1969 23 p refs
(AD-691244; NSRDC-2867) Avail: CFSTI CSCL 7/4

A theoretical equation which describes interfacial tension of binary solutions as a function of concentration, and of the interfacial tensions and the molecular areas of the pure components has been applied to organic and aqueous systems against water and mercury. The derived equation gives information as to molecular area and orientation of adsorbed molecules at an interface. Gibbs equation, while applicable to all interfaces, generates no detailed structural information. The derived equation is useful for determining the interfacial structure of solutions approximating its theoretical model. Author (TAB)

N70-11045# Naval Ammunition Depot, Crane, Ind. Research and Development Dept.
THE ANALYSIS OF LEAD DIOXIDE USING A MODIFIED HYDROGEN COMBUSTION TRAIN
William L. Ripley 10 Jun. 1969 28 p refs
(AD-691236; RDTR-146) Avail: CFSTI CSCL 7/2

Problems with traditional volumetric methods of analysis of lead dioxide have brought about the development of a procedure based on a modified hydrogen combustion train. The relationship between the purity of lead dioxide specimens and the heat of reaction and reactivity of compositions made from them is examined. Current attempts of a computer program to relate properties to performance by multiple regression analysis is discussed. Author (TAB)

N70-11075# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Solid State Science Branch.

EQUILIBRIUM CONSTANTS FOR GS PROCESS REACTIONS INVOLVING TRITIUM COMPOUNDS

D. P. Jackson Aug. 1969 20 p

(AECL-3382) Avail: CFSTI; Atomic Energy of Can., Ltd., Chalk River: $0.50

Since heavy water plants of the Girdler–Spevack type will likely be used for upgrading, it is necessary to understand the behavior of tritium in this process. Equilibrium constants have been calculated for several tritium exchange reactions involving water and hydrogen sulfide using the statistical partition function method. The effects of phase changes and pressure on the calculated equilibrium constants are considered for conditions relevant to the Girdler–Spevack process. Author

N70-11082# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.

RADIOMETRIC DETERMINATION OF THE PLUTONIUM 241 CONTAINED IN A PLUTONIUM ISOTOPE MIXTURE RICH IN PLUTONIUM 242 [DOSAGE RADIOMETRIQUE DU PLUTONIUM-241 CONTENU DANS UN MELANGE DE PLUTONIUM RICHE EN ISOTOPE-242]

Raymond Pottier and Gérald Garcia Jul. 1969 43 p refs In FRENCH; ENGLISH summary

(CEA-R-3774) Avail: CFSTI

The determination is achieved by an analytical treatment of the growth curve of americium-241 resulting from alpha-gamma coincidence spectrometric measurements. The principle of the method, the mathematical formulation, the formulation, the equipment used, the chemical purification and the preparation of the sources are described in this report. Analysis has also been performed for experimental verifications. An attempt has been made to review these results from the point of view of future improvements of this procedure. Author (ESRO)

N70-11093# Mellon Inst., Pittsburgh, Pa. Radiation Research Labs.

RADIATION RESEARCH Quarterly Report, 1 Jul.–30 Sep. 1968

8 Oct. 1968 23 p refs

(Contract AT(30-1)-2310)

(RRL-2310-251; Q-45) Avail: CFSTI

Research progress is reported on positive ion reactions in cyclohexane, effect of ion scavengers on atomic and molecular yields of hydrogen in radiolysis of hydrocarbons, electron scavenging by propyl bromides, hydrogen abstraction by perfluoroalkyl radicals, photolytic radical production in an SF_6 matrix, ESR studies of aqueous solutions during radiolysis, formation of radical anions in cyano and nitrobenzenes, radiation chemistry of aqueous solutions of NF_3, interaction of tricyanoanisole with methoxide ion, reactions of active nitrogen with nitrosyl chloride, flash photolytic studies of dichloride ion, photosensitized photolysis of cyclopropane, electron reactions in gases, and synthesis of ESR spectra. NSA

N70-11100# Providence Coll., R.I. Dept. of Physics.

AN ATTEMPT AT AN ANALYSIS OF THE ALGEBRAIC STRUCTURE OF VIBRATIONAL-ROTATIONAL INTERACTIONS IN MOLECULES Final Report, 1 Feb. 1967–30 Apr. 1969

Edwin K. Gora 30 Apr. 1969 96 p refs

(Contract F19628-67-C-0156)

(AD-691281; AFCRL-69-0247) Avail: CFSTI CSCL 7/4

In recent years, the theory of vibrational-rotational(v-r) interactions in polyatomic molecules has reached a formidable degree of complexity, in particular, in derivations of terms of sixth power in the angular momentum. In an attempt to simplify these derivations, and to extend them to terms of eighth and tenth power in the angular momentum, we have developed an algebraic procedure following closely the convantional treatment of v-r interactions in diatomic molecules. The minimum of an energy function representing the v-r energy of the rotating molecule is chosen as the origin of a new coordinate system. A Minimization Theorem simplifies substantially the algebraic procedures. The derivation of general results is straightforward but only a systematic analysis of the algebraic structure of the results obtained makes their application to particular molecular models feasible. Author (TAB)

N70-11134*# Whittaker Corp., San Diego, Calif.

STUDY OF HIGHLY FLUORINATED HETEROCYCLIC POLYMERS FOR CRYOGENIC BLADDER APPLICATIONS Quarterly Letter Report, 15 Jul.–15 Oct. 1969

31 Oct. 1969 8 p ref

(Contract NASw-1822)

(NASA-CR-106644; Rept-4) Avail: CFSTI CSCL 07C

Continuing research on the synthesis and characterization of the polymer systems is reported. Diacid fluoride of poly(perfluorpropylene oxide) was prepared, and then was reduced to poly(perfluoropropylene oxide) gycol and was also reacted with melamine-capped heterocyclic prepolymer. The polyimide synthesis based on the reaction of a diisocyanate with a tetracarboxylic dianhydride was applied to isocyanate-capped perfluoropolypropylene oxide bis-urethane prepolymer. The preparation of an extended N-aminotriazole heterocyclic elastomer based on a perfluorinate polyether is described. Efforts in preparing highly extended 1,3,4,-oxadiazole heterocycle precursor systems are discussed, and efforts indicated that the glass transition temperature decreases with the extent of chain extension. N.E.N.

N70-11167*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

A METHOD FOR PREPARING STABLE NONPOLARIZABLE SILICON DIOXIDE LAYERS ON SILICON Patent Application

Ronald A. Cohen, inventor (to NASA) Filed 30 Jul. 1969 7 p

(NASA-Case-ERC-10071; US-Patent-Appl-SN-845975) Avail: CFSTI CSCL 07B

A method for preparing a stable, nonpolarizable oxide for use as passivation and dielectric for semiconductor devices, integrated circuits, insulated gate field-effect transistors (MOSFET's) and the like is disclosed. The method comprises the steps of: (1) forming a layer of silicon dioxide on a silicon substrate by any known method; (2) depositing a phosphosilicate glass film on the silicon dioxide layer to serve as a getter for mobile ions; (3) etching the layer of phosphosilicate glass to remove any mobile ions present in the glass or at the glass–silicon dioxide interface to prevent polarization effects; and (4) repeating steps 2 and 3, if necessary, until a stable oxide is formed. NASA

N70-11172 Stanford Univ., Calif.

A SPECTROPHOTOMETRIC STUDY OF CERTAIN BINUCLEAR COMPLEXES SHOWING INTERACTION ABSORPTION

Bernhard Binder (Ph.D. Thesis) 1968 255 p

Avail: Univ. Microfilms: HC $11.50/Microfilm $3.30 Order No. 69-8154

The investigations presented contribute to the elucidation of the cause for the abnormally intense color, called interaction absorption, which is shown by aqueous solutions containing a suitable ligand and two metal ions. Organic ligands giving rise to interaction absorption were found to possess ordinarily two or more functional groups which are capable of complexing the metal ion and are separated by no more than one methylene group. These studies and earlier work have shown that interaction absorption is observed with several elements that exist in two oxidation states in solution; included are Fe(II)-Fe(III), Sn(II)-Sn(IV), Sb(III)-Sb(V) and Cu(I)-Cu(II). It has been shown in the present study that this type of absorption is also exhibited when a combination of Fe(III) and Sn(II) is employed. Dissert. Abstr.

N70-11202# Massachusetts Univ., Amherst. Goessmann Lab.
LASER LIGHT SCATTERING BY POLY-ALPHA-AMINO ACID SOLUTIONS
Frank E. Karasz, Norman C. Ford, Jr., and Wylie Lee 1 Nov. 1968 4 p refs
(Grants AF-AFOSR-1434-68; NSF-GP-7912)
(AD-692238; AFOSR-69-2038-TR) Avail: CFSTI CSCL 7/4

An improved self-beat spectrometer has been used to study the spectrum of light, from a He-Ne laser, scattered by solutions of poly-gamma-benzyl-L-glutamate (PBG). From the observed spectral broadening, the translation diffusion constants of the solvated polymer were calculated. Diffusion constants were measured also as a function of solvent composition. A change in the diffusion constant at about 76% dichloroacetic acid (at 25C) reflected the well-known helix-coil transition of PBG. Author (TAB)

N70-11216# Michigan Univ., Ann Arbor. Infrared Physics Lab.
STRENGTHS AND WIDTHS IN THE FIRST OVERTONE BAND OF HYDROGEN FLUORIDE
R. E. Meredith Aug. 1969 36 p refs
(Contract DAHC15-67-C-0062)
(AD-691900; Rept-8416-27-T) Avail: CFSTI CSCL 7/4

The strengths and self-broadened half widths of 18 lines of the first overtone band of hydrogen fluoride have been measured using a direct measurement method. The lines were assumed to have the Lorentz or combination Lorentz-Doppler shape. Matrix elements have been calculated for a dipole moment function. Line widths were calculated using the Anderson theory. The first-order effect of the vibrational quantum number on the half widths has been taken into account, and a comparison with measurements on the pure rotation and fundamental bands has been made. Author (TAB)

N70-11233*# Techtran Corp., Glen Burnie, Md.
TUNGSTEN HEXAFLUORIDE [L'HEXAFLUORURE DE TUNGSTENE]
Maurice Carles Washington NASA Nov. 1969 26 p refs Transl. into ENGLISH of French Report CEA-BIB-125, Sept. 1968
(Contract NASw-1695)
(NASA-TT-F-12662; CEA-BIB-125) Avail: CFSTI CSCL 07B

Tungsten hexafluoride is generally prepared either from tungsten hexachloride and hydrofluoric acid used as a reactant or by direct synthesis of its components. It appears as a colorless gas ten times denser than the air. Solid tungsten hexafluoride is a white body which melts around minus 0.4 C and boils around 17 C under air pressure. Symmetrical in structure, the molecule consists of one metal atom in the center of an octahedron the apexes of which are occupied by fluorine atoms. Highly reacting, tungsten hexafluoride fumes in the air and corrodes practically all metals except gold and platinum. It forms addition compounds with sodium, potassium, rubidium, cesium, manganese, and ammonium fluorides, and also with some nitrogen compounds like nitrile and nitrosyl fluorides and nitrogen tetroxide. It can be reduced by many compounds such as HCl, HBr, HI, and CO to give subfluorides. Metal tungsten hexafluoride is obtained with high temperature hydrogen. This reaction is often used to obtain deposit films or to make tungsten objects. Author

N70-11248# Indiana Univ., Bloomington. Dept. of Chemistry.
COMPLEXES OF B9H10CHP NEGATIVE AND B9H10CHAs NEGATIVE WITH GROUP 6 METAL CARBONYLS
Lee J. Todd, Howard T. Silverstein, and Don C. Beer Jul. 1969 27 p refs
(Contract N00014-67-A-0289)
(AD-691289; TR-1) Avail: CFSTI CSCL 7/2

The photochemical reaction of (CH3)4N(B9H10CHE) (E = P or As) with group VI metal carbonyls lead to the formation of complexes of the general formula, (CH3)4N(B9H10CHEM(CO)5). Available evidence suggests that the phosphorus or arsenic atom of the ligand is sigma bonded to the metal carbonyl in these new derivatives. Author (TAB)

N70-11251*# McDonnell-Douglas Astronautics Co., Santa Monica, Calif. Astropower Lab.
NEW POLYMERS OF PERFLUOROBUTADIENE AND METHOD OF MANUFACTURE Patent Application
Madeline S. Toy, inventor (to NASA) and James M. Newman, inventor (to NASA) Filed 7 Aug. 1969 8 p
(Contract NAS7-603)
(NASA-Case-NPO-10863; US-Patent-Appl-SN-848325) Avail: CFSTI CSCL 07C

A polyperfluorobutadiene which is a copolymer of perfluoro-1, 2- and 1,4-butadiene is made by initiating the polymerization of perfluorobutadiene with diisopropyl peroxydicarbonate. Author

N70-11252*# McDonnel-Douglas Astronautics Co., Santa Monica, Calif. Astropower Lab.
METHOD OF POLYMERIZING PERFLUOROBUTADIENE Patent Application
Madeline S. Toy, inventor (to NASA) Filed 7 Aug. 1969 11 p
(Contract NAS7-603)
(NASA-Case-NPO-10447; US-Patent-Appl-SN-848351) Avail: CFSTI CSCL 07C

Perfluorobutadiene is polymerized under low pressure and ambient temperatures in the presence of certain peroxide catalysts to obtain high polymer yields. Author

N70-11278*# National Aeronautics and Space Administration, Washington, D.C.
THE REACTIVITY OF SODIUM CHLORATE
E. Osada et al Nov. 1969 20 p refs Transl. into ENGLISH from Kogyo Kayaku Kyokaishi (Tokyo), v. 27, no. 2, 1966 p 91–100
(NASA-TT-F-12679) Avail: CFSTI CSCL 07C

The reactivity of sodium chlorate was studied from the view points of the thermal decomposition reaction, and the reactions of sodium chlorate with sulfuric acid, hydrochloric acid, and some organic compounds. The thermal decomposition occurs at about 440 C. At first sodium chlorate decomposes into sodium chloride and oxygen. The oxygen atoms react with undecomposed sodium chlorate, producing sodium perchlorate. Sodium chloride accelerates the decomposition of sodium chlorate. The molar ratio of the reaction is varied with temperatures, and the maximum value of the ratio is 75/25 at 520 C. When sodium chlorate is completely decomposed at 530 C, the ratio is 67/33. This autocatalytic decomposition reaction of sodium chlorate has the activation energy of 49 kcal. Above 540 C, sodium perchlorate decomposes into sodium chloride and oxygen, and its activation energy is 70.5 kcal. The catalytic effect of sodium chloride on the decomposition of sodium chlorate is only detected with the chemical analysis of the reaction products. Ignition reaction of sodium chlorate–organic compounds occurs at the melting point of sodium chlorate, and the activation energies were obtained as 30-50 kcal. Author

N70-11283# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
INVESTIGATION OF A SENSITIZED CIS-TRANS-PHOTOISOMERIZATION OF 1.2 DICHLORETHYLENE WITH MICROWAVES [UNTERSUCHUNG DES ABLAUFS EINER SENSIBILISIERTEN CIS-TRANS-PHOTOISOMERISIERUNG VON 1, 2-DICHLORAETHYLEV MIT MIKROWELLEN]
W. Schneider Apr. 1969 40 p refs In GERMAN; ENGLISH summary
(IPP-3/91) Avail: CFSTI

Measurements made by N. Kaiser have shown that exposure of cis or trans-dichlorethylene to UV light results in a change of the complex dielectric constant, which can be observed with a sensitive microwave measuring bridge. Unlike other methods, this

allows investigation during the photoreaction. In this report the cis-trans isomerization of 1,2 dichlorethylene caused by UV light was investigated by means of microwaves. Isomerization was greatly accelerated by adding small quantities of bromine. The bromine had much the same effect as a catalyst, but the halogens chlorine and iodine had no such influence. Author (ESRO)

N70-11311# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.
A PROOF THAT ESSERGY IS THE ONLY CONSISTENT MEASURE OF POTENTIAL WORK FOR CHEMICAL SYSTEMS Final Scientific Report
Robert B. Evans Jun. 1969 147 p refs
(Grants AF-AFOSR-1735-69; NSF TGK-1344)
(AD-691899; AFOSR-69-1976-TR) Avail: CFSTI CSCL 20/13

An attempt is made to prove that all of the many seemingly independent measures of potential work, such as availability, exergy, available work, Gibbs free energy, Gibbs chemical potential, Helmholtz free energy, and other common energy expressions are necessarily all special cases of a unique quantity that is called essergy, a contraction of the term essence of energy. The proof is attempted rigorously for chemical systems, and then is extended. If correct, the proof will be of consequence to the design of any engineering system in which potential work is a significant factor, since it will show that by evaluating the one quantity, essergy, the designer will have taken account of the other seemingly independent considerations. A possible consequence of the proof may be a more general formulation for the concept of information based on Brillouin's principle of the equivalence of thermodynamic information and potential work. The proof indicates that negentropy is not as general a measure of potential work as is the quantity, essergy. This result could imply that essergy is a more general measure of thermodynamic information than negentropy, an implication that might lead to a broader formulation about information and, thus, new insight into the foundations of information theory. Author (TAB)

N70-11317 Northwestern Univ., Evanston, Ill.
OPTICAL PROPERTIES AND ELECTRICAL CONDUCTIVITY OF SEVERAL INTERMETALLIC COMPOUNDS
David Arnold Kiewit (Ph.D. Thesis) 1968 191 p
Avail: Univ. Microfilms: HC $8.80; Microfilm $3.00 Order No. 69-1865

The optical properties of CoAl, CoGa, and NiGa were studied as functions of composition and photon energy in the spectral region from 0.7 to 6.3 eV. The experimental specimens were prepared by a mechanical polishing technique that was shown, by the use of annealing studies, to produce surfaces from which reliable optical data could be taken. Measurements were made by the use of two polarimetric techniques on a reflectometer that was designed by the author. Similar investigations were conducted on NiAl between 0.7 and 2.0 eV. The measurements to the optical properties were supplemented by a survey of the low temperature reflectivity of all four alloys. The optical properties of the investigated materials, expressed in terms of the real and imaginary parts of the dielectric constant, the normal incidence reflectivity, the absorption constant, the loss function, and the conductivity at optical frequencies are presented in both graphical and tabular form in the thesis. These results indicate that some of the investigated alloys show free electron like behavior in the infra-red. Dissert. Abstr.

N70-11318 Stanford Univ., Calif.
INDUCED ELECTRON TRANSFER: THE OXIDATION OF PENTAAMINE-(PYRIDINEMETHANOL)COBALT (III) COMPLEXES
James Edwin French (Ph.D. Thesis) 1968 129 p refs
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-8180

The reactions of 3 and 4-pyridinemethanolpentaammine-cobalt(III) complexes with one-electron oxidants were studied to determine the nature of the radical ligands formed and the rate at which they could reduce the cobalt(III) center. The reaction with cerium(IV) shows the dependence of the stoichiometry on cerium-(IV) concentration where two alcohol radicals are formed, one which can be trapped by cerium(IV) and oxygen or reduce the cobalt(III) center, and one which undergoes internal reduction too rapidly to be trapped by cerium(IV) or oxygen. Excess cobalt(III) or silver(I) catalyzes the reaction and the rate becomes independent of substrate and first order in catalyst. The catalysis is believed to be due to generation of cobalt(III) and silver(II) by cerium(IV), followed by rapid reaction of the oxidized catalyst with complex.
Dissert. Abstr.

N70-11321 South Carolina Univ., Columbia.
INFRARED AND RAMAN INVESTIGATION OF THE ISOMERIZATION OF SOME FLUORIDE AND CYANIDE CONTAINING COMPOUNDS
James William Clark (Ph.D. Thesis) 1968 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-5793

The infrared spectra of $SPCl_3$ and $SPCl_2F$ in both the liquid and gaseous states, and $SPClF_2$ and SPF_3 in only the gaseous state have been recorded. The Raman spectra have also been recorded and depolarization values measured. Complete vibrational assignments based on band contours, positions and depolarization values are given. The spectra are interpreted in detail assuming C_s symmetry for $SPCl_2F$ and $SPClF_2$ and C_{3v} symmetry for the other two molecules. The P–S stretching vibration is found to decrease in frequency with the increased number of fluoride atoms attached to the phosphorus atom. The Raman spectra of liquid N_2F_4 at temperatures ranging from –60 to –150 C have been recorded. Depolarization values have been measured. The far infrared spectrum of the vapor and solid has also been reinvestigated. Seventeen pronounced Raman lines have been observed whereas the C_2 isomer or tetrafluorohydrazine has only twelve fundamentals. Dissert. Abstr.

N70-11347 National Lending Library for Science and Technology, Boston Spa (England).
CERTAIN CHARACTERISTICS OF THE DEVELOPMENT OF SILVER THIOCYANATE PHOTOGRAPHIC EMULSION [NEKOTORYE OSOBENNOSTI PROYAVLENIYA RODANOSEREBRYANOI FOTOGRAFICHESKOI EMULSII]
N. V. Polyakova Jul. 1969 8 p refs Transl. into ENGLISH from Usp. Nauchn. Fotogr. (Moscow), v. 13, 1968 p 53–56
(NLL-RTS-5129) Avail: Natl. Lending Library, Boston Spa, Engl.: 10s

Experiments on the development of the photographic properties of the silver thiocyanate emulsion and the influence of excess thiocyanate and bromine ions on the development kinetics are reported. Hydroxylamine and metal /hydroquinone developers of differing composition and pH were used. Kinetics of the reactions in image and fog development, spectral sensitivity, maximal density, and contrast coefficients in the wavelength 436 to 254 nm were measured in the presence and absence of the ions. The kinetics curves have the following characteristics: (1) There is a rapid speeding up at the beginning with a gradual slowing. (2) When thiocyanate and bromine ions are added in the presence of hydroxylamine, the beginning of the curve is moved toward longer times and greater maximal density is obtained. (3) A correspondence between the development of the silver thiocyanate emulsion and the reactions in the reclamation of silver thiocyanate residues was demonstrated. M.H.E.

N70-11348# Manchester Coll. of Science and Technology (England). Dept of Chemistry.
INHIBITION OF THE THERMAL REACTION BETWEEN HYDROGEN AND OXYGEN Final Scientific Report

Norman Armstrong and Robert F. Simmons 1 Apr. 1969 31 p refs
(Contract AF-EOAR-31-66)
(AD-692197; AFOSR-69-1959-TR) Avail: CFSTI CSCL 7/2

The effect of hydrogen bromide on the second limit of the hydrogen-oxygen reaction in B2O3-coated vessels was examined in detail, in terms of a mechanism suggested earlier. The effect of ethyl bromide on the first limit of the reaction has been studied using clean silica vessels and it is shown how the inhibition occurs. Author (TAB)

N70-11351 National Lending Library for Science and Technology, Boston Spa (England).
MEASUREMENT OF VAPOUR AND DISSOCIATION PRESSURE OF POTASSIUM SULPHATE AT HIGH TEMPERATURE
T. Kosugi 18 Jul. 1969 15 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 70, 1967 p 2089–2093
(NLL-CE-Trans-4939-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The saturated vapor pressure and dissociation pressure of potassium sulphate were measured by Knusden effusion method in the range of 1400 to 1700 K. The data of effusion rate of sample vapor are discussed by separating them into one component due to evaporation and the other due to thermal dissociation by the method of approximation of elementary functions. The average value of heat of vaporization was found to be 57.3 + or − 8.6 kcal/mol, entropy change by evaporation at m.p. was 42.7 + or − 6.4 cal/deg/mol, and change of free energy by evaporation at m.p. was 9.88 + or − 1.48 kcal/mol. On the other hand, thermal dissociation of potassium sulphate developed near 1550 to 1560 K and the dissociation reaction was estimated to be K_2SO_4 yields $K_2O + SO_2 + 1/2\ O_2$. Dissociation pressure was determined from the above dissociation reaction as the following equation: log P sub D = −3.275 times 10-4/T + 20.83. Heat of dissociation of potassium sulphate was 150 + or − 22.5 kcal/mol. Author

N70-11358 National Lending Library for Science and Technology, Boston Spa (England).
DRYING OF GAS WITH SOLID CALCIUM CHLORIDE AND ITS SOLUTION [OSUSHKA GAZA TVERDYM KHLORISTYM KALTSIEM I EGO RASTVOROM]
V. I. Popov Jul. 1969 15 p refs Transl. into ENGLISH from Tr. Vses. Nauchn.Issled. Inst. Prirod. Gazov (USSR), 1966 p 22–27
(NLL-RTS-5259) Avail: Natl. Lending Library, Boston Spa, Engl.: 15s

Experiments with solid and aqueous calcium chloride to obtain design data for industrial drying of natural gas are reported. Because the stable operation of the liquid absorption column depends on the correct functioning of the injection plates, calculation of the injection plates and injection coefficients were investigated. The pressure drop of natural gas through wet versus dry beds of 5 to 30 mm particle size calcium chloride, the hydraulic resistance of the plates at gas pressures of 44 and 25 atm, and the effect of structural details in the plate on hydraulic resistance are indicated in graphs. Both experimental data and formulas are used to draw the following conclusions: (1) Anhydrous calcium chloride of 5 to 30 mm particle size packed to a height of 1500 mm and five injection plates operating with its solution achieve optimum drying of natural gas, to a −25 to −30 deg C dew point. (2) A single injection plate under the noted experimental conditions lowers the dew point of gas by 3 to 4 deg C. (3) A method of calculating the injection plates and the optimum parameters of drying were determined. M.H.E.

N70-11391# American Cyanamid Co., Stamford, Conn. Central Research Div.
A FEASIBILITY STUDY OF VISCOUS CHEMICAL LIGHTING SYSTEMS Final Report
Michael M. H. Rauhut and Nelda M. Smith Crane, Ind. Naval Ammunition Depot Jun. 1969 83 p refs
(Contract N00164-69-C-0185)
(AD-692410; NAD-CR-RDTR-153; Rept-1432-97F) Avail: CFSTI CSCL 7/3

In fulfillment of the contract objective, a three-component, thixotropic chemical lighting system was developed which is capable of providing a brightness greater than 4.7 foot-lamberts for a period of 30 minutes and a brightness greater than 2.8 foot-lamberts for a period of one hour when applied to grease-coated surfaces. Higher brightnesses and longer lifetimes are obtained on most surfaces in the absence of grease. Since the brightness is proportional to the thickness of the luminescent layer, the brightness can be adjusted to meet most marking requirements by adjusting the thickness of the applied layer. The three components of the system are mobile fluids and are easily mixed. After mixing, the combined system is highly thixotropic; and while the system is mobile under stress to permit its application to surfaces, it does not flow spontaneously. Thus thick stable layers can be applied to vertical or porous surfaces. The storage stabilities of the three components were found to be satisfactory in short-term accelerated stability tests. Although longer-term testing will be required to insure that the stabilities meet practical storage requirements, the results suggest that practical requirements can be accommodated. Author (TAB)

07 COMMUNICATIONS

Includes communications equipment and techniques, noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N70-10081# Federal Communications Commission, Washington, D.C.
FREAVY: A FREQUENCY AVAILABILITY COMPUTER PROGRAM
John Williams and Philip Tremper May 1969 198 p refs
(PB-183614; FCC-6901) Avail: CFSTI CSCL 17B

FREAVY is an acronym for a computer program devised by the FCC's Office of Chief Engineer to provide ready access to basic information on frequency availability. The input data base consists of information derived from current FCC Rules and Regulations and includes frequencies allocated to the land mobile radio services, the specific classes of stations permitted, and special footnote limitations on use. While the initial effort has been limited to the land mobile radio services and frequencies, the computer program is equally applicable to all radio services once appropriate data has been extracted from the Rules. The attached computer list 'Available Frequency File—Land Mobile Radio Service' is the principal output of the program. This list should be of special value to anyone who has ever searched manually through volumes of rules in an attempt to obtain a complete picture of what is or is not permitted on a particular frequency. Author (USGRDR)

N70-10115 California Univ., Los Angeles.
PERFORMANCE OF STOCHASTIC-SIGNAL COMMUNICATION SYSTEMS USING SPECTRAL ESTIMATORS
James Walter Haake (Ph.D. Thesis) 1968 99 p refs
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-7244

The performance of communication systems involving random channels with known statistical properties was previously studied.

It was the purpose of the present work to extend these results to the case in which the random channel parameters must be estimated at the receiver. Bounds on the error probability were obtained when a method of eigenvalue estimation was used. The results were then applied to the problem of decision directed channel estimation, for which some conclusions regarding stability of the process were drawn. Dissert. Abstr.

N70-10153# Westinghouse Electric Corp., Baltimore, Md.
MARITIME MOBILE SATELLITE COMMUNICATIONS TESTS PERFORMED ON S. S. SANTA LUCIA Final Report
1969 114 p
(Contract MA-4329)
(PB-183971) Avail: CFSTI CSCL 17B

The feasibility of using space techniques for communication to an inexpensive shipboard terminal was demonstrated. It is shown that simplex, duplex or semi-duplex voice circuits; digital computer data; teletype, facsmile and time synchronization of a digital clock are feasible. Results of the propagation, voice channel, digital data, time synchronization and ranging tests are presented. The requirements for a shipboard antenna are analysed. Recommendations are made, based on observations made during the test program, for the effort required to provide an operational maritime mobile satellite system. Author (USGRDR)

N70-10203# National Academy of Engineering, Washington, D.C.
REPORTS ON SELECTED TOPICS IN TELECOMMUNICATIONS Final Report
Nov. 1968 160 p refs
(Contract HUD-H-952)
(PB-184438) Avail: CFSTI CSCL 17B

The Committee on Telecommunications undertook a preliminary review of certain technical and economic data made available to it by the President's Task Force. The Task Force was charged to conduct a comprehensive examination of telecommunications in national affairs. Its responsibilities ranged from the progress of technology through certain domestic issues, the utilization of the spectrum, and various international issues, all the way to an examination of new institutions and organizations needed to realize the greatest benefits from the nation's telecommunications resources. The subjects are those having large technological content. They fall into the broad areas of satellites and other long-haul transmission modes, spectrum utilization and management, and telecommunications or related electronic technology in urban life. Author (USGRDR)

N70-10284# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS
May 1969 44 p refs
(PB-184248) Avail: CFSTI CSCL 14B

Summaries are given of research in the following fields: acoustics, atmosphere and astrophysics, chemistry, communications sciences, metallurgy, nuclear and atomic physics, ocean sciences, ocean technology. USGRDR

N70-10272# Idaho Univ., Moscow.
AN EXPERIMENTAL INVESTIGATION OF THE CHARACTERISTICS OF INFRASONIC NOISE IN THE ATMOSPHERE
Lary Alvin Cross (M.S. Thesis) Aug. 1968 71 p refs Sponsored by NSF
Avail: CFSTI

The characteristics of atmospheric noise have been determined for many frequency ranges but very little investigation has been made into the infrasonic range of frequencies (below 1 Hz). The characteristics of infrasonic noise were determined for the three month period from June through August of 1968. The data were sampled at selected periods of the day and the characteristics of the noise were determined for these daily periods on a monthly basis. Infrasonic noise was shown to have a mean value of zero, to follow the normal distribution, and to have a wide-band frequency spectrum. It was also shown that infrasonic noise is not ergodic but that it may be stationary for selected periods. Author

N70-10297# Sandia Corp., Albuquerque, N. Mex.
NONLINEAR EFFECTS IN TELEMETRY TRANSMITTER-RECEIVER RF LINKS Research Report
Charles S. Johnson and Raymond M. Caster May 1969 129 p refs
(PB-184352; SC-RR-69-138) Avail: CFSTI CSCL 09F

The report discusses the forms of distortion that can affect the quality of data transmitted on RF Links. Nonlinear and delay distortions were singled out for experimental investigation. Nonlinear effects such as intermodulation on Transmitter-Receiver RF Links were measured by both the Notch-Noise Test and the Two-Tone Test. The delay distortion was determined by measuring the phase linearity across the baseband and reducing it to group delay data. These three tests were run on a number of representative transmitters and receivers to obtain experimental data that could be used to establish the performance of present-day telemetry links. Author (USGRDR)

N70-10302# Texas Univ., Austin. Antennas and Propagation Lab.
ANALYSIS OF LOW ALTITUDE RADAR ECHOES OBSERVED UNDER CLEAR AND PARTLY CLOUDY CONDITIONS
A. H. LaGrone, Allan B. Plunkett, and A. P. Deam 15 May 1969 24 p ref
(Grant NSF GA-772)
(PB-184645; P-31) Avail: CFSTI CSCL 17I

Simultaneous observations of regions of disturbed index of refraction were made with high gain, high powered X- and S-band radars and two microwave refractometers. The two microwave refractometers were spaced vertically a distance of 17.5 cm and flown through the source regions of the radar echoes. Regions of disturbed index of refraction were consistently detected by the S-band radar and verified by the microwave refractometers. Additional qualitative verification of the disturbed regions was obtained by the temperature gage on the aircraft which showed a constant temperature (well mixed air) layer at the same altitude as the echoes received on the S-band radar and by the pilot who reported physical turbulence at the same altitude. The intensity of refractive index fluctuations, computed from the radar signal was found to be in good agreement with the intensity of refractive index fluctuations computed from the refractometer data. Author (USGRDR)

N70-10370# Rome Air Development Center, Griffiss AFB, N.Y.
A THEORETICAL EVALUATION OF THE FPS-6 RADAR ANTENNA IN TROPOSCATTER COMMUNICATIONS SYSTEMS Final Technical Report
Jul. 1969 24 p refs
(Contract AF30(602)-4197)
(AD-691906; RADC-TR-69-69) Avail: CFSTI CSCL 17/2.1

The report theoretically analyzes the effect of using a fan-shaped antenna reflector, having an aspect ratio of 3.5 to 1, for troposcatter communications. The analysis is performed relative to the performance which would be achieved when using a circular cross-sectioned parabolic reflector having the same free-space antenna gain. Parameters which are considered in the analysis include the orientation of the fan-shaped reflector, aperture-to-medium coupling loss, differential path delay, and scatter models based on Waterman and Friis-Crawford-Hogg. Author (TAB)

N70-10391# Chain Lakes Research Associates, Inc., Detroit, Mich.
DUAL INPUT TRANSPONDER Final Report
Zdzislaw I. Szewczyk Dec. 1968 41 p
(Contract FA-67-WA-1781)
(SRDS-RD-68-64) Avail: CFSTI

Three Feasibility Models of the Dual Input Transponder (D.I.T.) have been built. The equipment was used to test one method of eliminating the loss of ATC transponder replies which occurred during aircraft maneuvers when parts of the airframe or engine nacelles were interrupting the line of sight between the transponder and the ground interrogator. The D.I.T. is provided with two transmitting receiving antennas located on the airframe in positions such that for almost every aircraft attitude one or the other of the antennas will have an uninterrupted line of sight to the various ATC interrogators in the range of the D.I.T. equipped aircraft. The interrogating signals arriving at the two antennas are received by two parallel receiver channels and the amplitude of the detected signals compared. Based on this comparison, a decision is made to switch the output of the transponder transmitter to the antenna which has received the larger interrogating signal. Author

N70-10454# Naval Research Lab., Washington, D.C. Electronic Warfare Div.
DESIGN OF A DIGITAL CONTROL UNIT FOR AN NRL RECEIVING SYSTEM Final Report
Joseph M. Abell 1 Aug. 1969 20 p
(AD-692380; NRL-6897) Avail: CFSTI CSCL 17/2.1

To provide required receiver tuning accuracy a digital control unit for the receiver local oscillator was designed and constructed. The approach used a voltage-controlled oscillator in a closed-loop feedback system. The requirements were to control the receiver local oscillator from 175 MHz to 180 MHz in 1-kHz increments with provisions for both manual or computer control of the receiver. The digital control unit was breadboarded, using integrated circuits as the building blocks. The basic principle used to establish control of the local oscillator was the comparison of phase between a standard reference signal and a function of the local oscillator frequency. The error voltage established from this comparison was then used to control the local oscillator. Author (TAB)

N70-10457# Naval Ordnance Lab., White Oak, Md.
OPTIMUM AND SUB-OPTIMUM COMPRESSION OF SECOND ORDER MARKOV DATA
Arthur J. Bruckheim 10 Jun. 1969 153 p refs
(AD-692379; NOLTR-69-46) Avail: CFSTI CSCL 9/6

A new and more realistic model for telemetry data has been developed and analyzed. The model is Markovian in nature due to each data samples statistical dependence on previous sample values and activity state. The conditional mode and conditional mean predictors are derived from the data model and shown to be optimum compression techniques. For the optimum techniques, expressions are developed for the error probability distribution and the redundant sample run length distribution as a function of aperture width. Monte Carlo techniques are employed to generate several varieties of data from the proposed model. Conventional compression methods such as the fan interpolator and the zero-order predictor are then used to process the generated samples. Experimental results confirm the superiority of the optimum techniques and also indicate that of the two conventional methods, the fan technique is preferred for small apertures whereas the zero-order predictor is more efficient for large aperture processing. Author (TAB)

N70-10485# Technology, Inc., Dayton, Ohio.
STUDY OF DATA SOURCES AND PROCESSING FOR RADAR LAND MASS SIMULATION Final Report, Jan. – Dec. 1968
Patrick D. Fligor AFHRL Jun. 1969 91 p refs
(Contract F33615-68-C-1300)
(AD-692122; AFHRL-TR-69-1) Avail: CFSTI CSCL 17/9

To generate input data with a 50-foot resolution and fifteen shades of gray for advanced high-resolution digital radar simulators, this research examined and defined data sources and processing techniques. Limited to the Continental United States and to unclassified information, the data sources included all known aerial mapping imagery and topographic maps. All existing image processing techniques and devices were examined to define their operating principles. This review led to the conclusion that adequate geometric information for radar simulation data could be extracted from the current data sources and that existing processing capabilities could be combined into a feasible automatic system. In related work, non-parametric three-dimensional resections were calculated on a digital computer, and mathematical concepts were developed to give a computer system the capability of interpreting the physical characteristics in photos by using cues as done by a trained photo interpreter. Author (TAB)

N70-10471# Rome Air Development Center, Griffiss AFB, N.Y.
NEW DEVELOPMENTS IN MODULATED SCATTERING INSTRUMENTATION FOR MEASUREMENT OF NEAR-ZONE ELECTROMAGNETIC FIELDS
Charles Lee Hudson Jun. 1969 80 p refs
(AD-691909; RADC-TR-69-240) Avail: CFSTI CSCL 20/14

The investigation has the following objectives: (1) To provide in one document the highlights of various scattering techniques for measuring near-zone electromagnetic field distributions, (2) To investigate the feasibility of using a laser beam to modulate a photoconductive scattering element, (3) To extend the application of the modulated scattering technique to lower frequencies, (4) To explore possibilities for making the modulated scattering technique more useful in practice. Two of the more promising modulated scattering techniques are selected for experimental evaluation at frequencies other than X-band. These include the use of an audio diode modulated scatterer and a light modulated scatterer. Author (TAB)

N70-10472# Army Foreign Science and Technology Center, Washington, D.C.
EXPERIENCE IN WORKING WITH THE GD-314 LIGHT TELEMETER
S. S. Plonskii et al 9 Aug. 1969 11 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 3, Mar. 1967 p 6–9
(AD-692486; FSTC-HT-23-674-68) Avail: CFSTI CSCL 17/8

The GD-314 Light Telemeter, a range-finding device for the precise determination of distances up to 900 meters, is described and evaluated as a result of field survey measurements taken during a 32-day period. Tables are provided showing mean-square and relative errors. The GD-314 is considered practical for field use due to low weight, economical power consumption and demonstrated stability of the optical and electrical circuits under adverse transportation conditions. TAB

N70-10527*# Massachusetts Inst. of Tech., Cambridge. Dept. of Political Science.
SATELLITE EDUCATIONAL TELEVISION FOR INDIA: AN EXAMINATION OF ECONOMIC AND POLICY ASPECTS
Lakshmi Prasad Vepa (M.S. Thesis) Jun. 1969 154 p refs
(Grant NGL-22-009-019)
(NASA-CR-106564) Avail: CFSTI CSCL 17B

The appropriateness of a satellite system for India is examined to see the advantages as well as the unique problems caused by a satellite. The paper proceeds to a systems analysis of four alternative strategies for providing nationwide TV coverage: terrestrial, direct broadcast, rebroadcast, and hybrid systems. Discounted total

cost over a 20-year period is used as the economic yardstick for determining the least-cost alternative for a given level of 'effectiveness'. The four alternatives are ranked on the basis of certain other criteria as well, and it is concluded that a 'hybrid' system (of direct and rebroadcast) would be the most appropriate alternative for India. A brief description of the airborne television system is included. Finally, the following important public policy issues are discussed: the relative roles of TV and radio, rural versus urban location of transmitters, policy for TV receivers, Central and state control, organization and management problems, financing and foreign collaboration. Author

N70-10534# Army Foreign Science and Technology Center, Washington, D.C.

APPLICATION OF A SENSITIVE TELEVISION SYSTEM TO THE TRACKING OF ARTIFICIAL SATELLITES

E. S. Agapov et al 16 Jun. 1969 7 p Transl. into ENGLISH from the Russian

(AD-692191; FSTC-HT-23-262-69) Avail: CFSTI CSCL17/B

The Crimean Astrophysical Observatory of the USSR Academy of Sciences has used an optical system with a small gelios-53 lens with a diameter of 80 mm and a focal length of 200 mm. This system is described in the article. The use of modern television systems increases the sensitivity by more than 100 times in comparison with ordinary photographic equipment. By using such a system, it is easy to seek, track, and record the position of artificial earth satellites up to the 9th stellar magnitude with a lens 80 mm in diameter. Author (TAB)

N70-10557 National Lending Library for Science and Technology, Boston Spa (England).

RADIO INTERFERENCE OF EHV STATIONS AT FREQUENCIES FROM 0.15 TO 30 Mhz

D. Kohoutova and J. Vokalek 18 Jul. 1969 6 p refs Transl. into ENGLISH from Bull. EGU, no. 2–3, 1967 p 16–19

(NLL-CE-Trans-4945-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Measurements have demonstrated that the frequency characteristics of sub-statio interference intensity and the relationship between radio interference and the distance from a sub-station (transverse field characteristics) exhibit basically the same trend as that of line conductors, i.e., interference drops with frequency and distance. However, the curves differ in steepness of the drop. The intensity of sub-station interference in extremely high voltage systems is usually higher than the interference intensity of a long power line for the same voltage. Interferences induced by the sub-stations are transmitted along the power line and are fully attenuated at a distance between 8 and 10 km from the sub-station. R.B.

N70-10616# Joint Publications Research Service, Washington, D.C.

INFORMATION NETWORKS AND COMMUTATION

27 Jun. 1969 80 p refs Transl. into ENGLISH from Inform. Seti Kommutatsiya (Moscow), 1968 p 5–29, 41–48, 78–81, and 133–138

(JPRS-48313) Avail: CFSTI

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3. APPLICATION OF INTEGRAL PROGRAMMING FOR SYNTHESIS OF OPTIMAL COMMUNICATION NETWORKS V. A. Bogatyrev p 49–54 refs (See N70-10619 01-07)

4. INVESTIGATING THE BEHAVIOR OF A STOCHASTIC AUTOMATION WITH VARIABLE STRUCTURE V. M. Chentsov p 55–59 refs (See N70-10620 01-08)

5. THE PROBLEM OF RESPONSE TIME OF A REED CONTACT A. A. Vitkova p 60–63 refs (See N70-10621 01-09)

6. ESTIMATES OF THE PROBABILITY OF CONNECTEDNESS OF A COMMUNICATIONS NETWORK GRAPH O. S. Krakovskaya et al p 64–76 refs (See N70-10622 01-07)

N70-10617# Joint Publications Research Service, Washington, D.C.

PROBLEMS IN CONSTRUCTING COMMUNICATIONS NETWORKS

G. B. Davydov et al *In its* Inform. Networks and Commutation 27 Jun. 1969 p 1–36 refs (See N70-10616 01-07)

Avail: CFSTI

The basic problems concerning the most efficient construction of a network and utilization of the channels and equipment are discussed. The information value is considered with respect to the national economy, and the factors affecting the network design are identified. The various communication channels, their grouping, carrying capacity, and junctions are described. Some of the problems discussed are commutation and control systems; network analysis, reliability, and stability; and use of artificial earth satellites. N.E.N.

N70-10618# Joint Publications Research Service, Washington, D.C.

A PROCEDURE FOR DECENTRALIZED DYNAMIC DISTRIBUTION OF INFORMATION FLOWS

A. V. Butrimenko et al *In its* Inform. Networks and Commutation 27 Jun. 1969 p 37–48 refs (See N70-10616 01-07)

Avail: CFSTI

A decentralized communication system covering a large geographic area with commutation junctions far apart is discussed. The network described permits any channel entering a commutation junction to be commuted with any channel leaving the junction. The method to identify the shortest paths connecting each pair of vertices is outlined. Damage to channels and junctions requiring long repair time, overloads of individual lines, and short term failure of channels and equipment at the junctions are considered. The network behavior is analyzed, and the probabilities of channel failure and channel requests are determined. N.E.N.

N70-10619# Joint Publications Research Service, Washington, D.C.

APPLICATION OF INTEGRAL PROGRAMMING FOR SYNTHESIS OF OPTIMAL COMMUNICATION NETWORKS

V. A. Bogatyrev *In its* Inform. Networks and Commutation 27 Jun. 1969 p 49–54 refs (See N70-10616 01-07)

Avail: CFSTI

Network synthesis is considered with respect to costs and reliability. The problem of constructing a minimum communications network and the optimal number of independent paths are discussed. N.E.N.

N70-10622# Joint Publications Research Service, Washington, D.C.

ESTIMATES OF THE PROBABILITY OF CONNECTEDNESS OF A COMMUNICATIONS NETWORK GRAPH

O. S. Krakovskaya et al *In its* Inform. Networks and Commutation 27 Jun. 1969 p 64–76 refs (See N70-10616 01-07)

Avail: CFSTI

The probability that at any time the branches and junctions of a communications network can be used for transmitting messages is discussed. Mathematical trees are used in the calculation, which can be performed readily on a digital computer. N.E.N.

N70-10688*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF SIGNAL AND NOISE TURNAROUND IN THE GODDARD RANGE AND RANGE RATE TRANSPONDER
T. J. Grenchik Aug. 1969 65 p refs
(NASA-TM-X-63729; X-551-69-323) Avail: CFSTI CSCL 17B

Statistical communication theory was used to derive the output power spectral density for a phase modulation process involving signal and noise at intermediate frequencies (bandpass modulation). The results were applied to determine ground system capability while tracking a near earth orbiting satellite, Nimbus-E, through a synchronous satellite tracking station, ATS-F. Final results are in the form of the ground system signal to noise power densities at the essential signal component frequencies. Recommendations are made for values of transponder bandpass, modulation index, and Nimbus-E antenna gain. Author

N70-10696*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL INVESTIGATION OF A PLASMA-COVERED CAVITY-BACKED SLOT ANTENNA
Thomas G. Campbell and William F. Croswell Washington Nov. 1969 23 p refs
(NASA-TN-D-5463) Avail: CFSTI CSCL 09F

The tuning (or detuning) effects of plasma upon an electrically small cavity-backed slot antenna have been studied by using a rectangular plasma slab. The results from the slot antenna are compared with experimental and theoretical results from a rectangular waveguide aperture at the same operating frequency. A Langmuir probe survey of the slab was made to determine the longitudinal, transverse, and normal variations of electron density. The rectangular waveguide measurements and calculations were also used to corroborate the electron density survey. Swept-frequency measurements indicated the increase in slot resonant frequency, and accompanying changes in signal strength were observed at the various resonant frequencies in air and in the plasma environment. The slot admittance measurements also indicated that plasma diagnostic information could be achieved during a reentry plasma experiment. Author

N70-10735# Purdue Research Foundation, Lafayette, Ind.
RESEARCH ON WORD SPOTTING Final Report, 1 Mar. 1967 - 30 Nov. 1968
George W. Hughes, Arthur S. House, and Kung-Pu Li May 1969 51 p refs
(Contract F19628-67-C-0276)
(AD-691278; AFCRL-69-0240) Avail: CFSTI CSCL 17/2

The research has had as its goal the determination and evaluation of feasible solutions and programmable procedures for automatic speech recognition with an immediate objective of detecting or recognizing any specified word in the context of continuous speech. The report describes the speech materials and spectral data developed for use during the investigation and outlines the major computer processing techniques under study. A primary recognition program utilizing formant-tracking and segment-labeling routines is described, together with a fundamental-frequency extraction procedure based on harmonic structure. In addition, the application of statistical techniques involving dispersion analysis and correlation measures to the analysis of spectra derived from continuous speech is described. Author (TAB)

N70-10788# Illinois Univ., Chicago.
LASER COMMUNICATION SYSTEMS
Richard G. Semonin and Daniel L. Stigliani, Jr. 1969 5 p
(Grant NSF GA-630)
(PB-185367) Avail: CFSTI CSCL 17B

This report describes an invention based on the idea of putting information on a laser beam by the use of reflecting surfaces of any material and the use of a laser light-sensitive device to detect the information. Using a Michelson interferometer, voice transmission on a laser beam was effected by vibrating either a mirror or the beam-splitter; vibration was accomplished by speaking close to one of these parts. Modulation of the laser beam is detected by a light-sensitive device, the information amplified, and sent to a speaker. The system works equally well at certain non-visible electromagnetic wavelengths. Author (USGRDR)

N70-10791# Westinghouse Electric Corp., Baltimore, Md.
MARITIME SATELLITE; VHF COMMUNICATIONS TERMINAL
30 Jun. 1969 143 p
(Contract MA-4329)
(PB-185467) Avail: CFSTI CSCL 17B

The prime requirements of this equipment are high sensitivity, low noise, high reliability, and moderate cost. A single voice-frequency channel is provided for communication over any terrestrial area illuminated by the satellite. Requirements for interface units are also defined to permit teletype, data transmission, and facsimile services. Additional interface units (filters) will permit multiplexing voice on the above optional services. In the multiplexing case there will be some loss in voice recognition quality and some reduction in the speed of the optional services. Individual specifications are presented for each major subsystem: Antenna, Preamplifier, and Transmitter/Receiver. Author (USGRDR)

N70-10850# President's Task Force on Communications Policy, Washington, D.C.
THE USE AND MANAGEMENT OF THE ELECTROMAGNETIC SPECTRUM, STAFF PAPER 7, PART 1
Eugene V. Rostow Jun. 1969 489 p refs
(PB-184421) Avail: CFSTI CSCL 17B

The purpose of this paper was to analyze the existing system of spectrum management and to suggest improvement. Part 2 encompasses the history and present structure of spectrum management; Part 3 describes and analyzes existing and potential demands for spectrum use; Part 4 describes the problem of ensuing efficient use under alternative management techniques; Part 5 explores the challenges to spectrum management which these problems imply; Part 6 evaluates several proposals for reform; and Part 7 presents findings and recommendations. Author (USGRDR)

N70-10851# President's Task Force on Communications Policy, Washington, D.C.
THE USE AND MANAGEMENT OF THE ELECTROMAGNETIC SPECTRUM, STAFF PAPER 7, PART 2
Eugene V. Rostow Jun. 1969 401 p refs
(PB-184422) Avail: CFSTI CSCL 17B

A comparison of the utilization of government and non-government spectrum allocations in urban areas: Public safety radio spectrum requirements; A cost comparison of common-user land mobile communications systems; Electromagnetic spectrum management - alternatives and experiments; Legal aspects of subjecting the electromagnetic spectrum to the market mechanism; Spectrum engineering - The key to progress. USGRDR

N70-10951# Groupe de Recherches Ionosphériques, Issy-les-Moulineaux (France).
A METHOD FOR MEASURING THE IONOSPHERIC AND MAGNETOSPHERIC PROPAGATION TIME OF THE VLF WAVES [UNE METHODE DE MESURE DU TEMPS DE PROPAGATION DES ONDES TBF DANS L'IONOSPHERE ET LA MAGNETOSPHERE]
V. Micic 17 Jun. 1968 49 p refs In FRENCH
(GRI-NT-73) Avail: CFSTI

A method for propagation time measurement of VLF waves through the ionosphere and the magnetosphere is applied to

transmission from the French FR-1 satellite. The accuracy of the measurements is limited to a few milliseconds by the present capabilities of the coordinated time system. Results are presented for two particular cases. ESRO

N70-11031*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
STUDY OF RECTANGULAR-GUIDE-LIKE STRUCTURES FOR MILLIMETER WAVE TRANSMISSION Progress Report, 1 Jun. - 30 Sep. 1969
Frederick J. Tischer 15 Oct. 1969 95 p refs
(Grant NGL-34-002-047)
(NASA-CR-106729) Avail: CFSTI CSCL 17B

Extensive research studies were carried out on H-guide and fence guide designs for milimeter wave circuit and transmission problems. Structures studied were: (1) the fence guide for design of millimeter wave circuitry; (2) the H-guide with laminated dielectric slabs; and (3) the beam guide. Emphasis was placed on effects of surface roughness on the loss characteristics of the waveguides. It was found that considerable improvement of surface resistance in H-guides and beam guides can be achieved by electro and chemical polishing. New transitions between rectangular waveguides, and fence guides and H-guides were designed and manufactured their characteristics showed good agreement with predicted values. The study of a confocal circular reflector guide continued by deriving relationships which show the contributions to the attenuation by wall losses and radiation in terms of cross-sectional dimensions. Theoretical methods of describing electromagnetic fields by wave analytical functions were developed and applied for the solution of boundary value problems related to guided waves. G.G.

N70-11053# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE OPTIMUM RESOLUTION OF RADAR OBJECTS
V. M. Gerasimov 1969 12 p refs Transl. into ENGLISH from Radiotekh. i Elektr., (USSR), v. 14, no. 9, 1969 p 1572 - 1583
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The resolving power of a radar system is defined by the minimum target diversity at which the system is still in a state to perform qualitatively the function imposed on it. Targets are resolved if their simultaneous presence in space does not result in extreme degradation of the fundamental characteristics of the given radar. A detection system which establishes the character of each detected object (single or group) and which determines its quantitative composition with greatest confidence will be optimal from the standpoint of resolving power. The resolving power for the measurement stage is the minimum target diversity for which the relative measurement errors or their coordinates do not emerge beyond admissible limits. R.B.

N70-11074# TRG, Inc., Menlo Park, Calif.
DEVELOPMENT AND TESTING OF HF WIRE-GRID LENS ANTENNA, VOLUME 3 Final Report
E. M. T. Jones Dec. 1968 110 p refs
(Contract FAA-ARDS-598)
(SRDS-RD-68-26-Vol-3) Avail: Issuing Activity

Results of a series of measurements made on the multibeam wire grid lens HF antenna to determine its message traffic handling capacity when equipped with optimized feeds are described. Error rate measurements were made of signals received on the lens operating simultaneously in the simplex mode and the angle diversity mode in which a signal is simultaneously received on a pair of beams pointing in slightly different azimuth directions. The median binary error rate for the simplex mode of operation was found to be .00033, while the median binary error rate for the angle diversity mode of operation was found to be .000027 which represents a 12 to 1 improvement. The fading characteristics of several single tone signals simultaneously received on the two beams of a feed connected in the angle-diversity mode were recorded and compared with the fading characteristics of the same single tone signals received on two space diversity rhombics. Author

N70-11076# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astrophysics Lab.
ELF PROPAGATION AND EMISSION IN THE MAGNETOSPHERE
H. B. Liemohn Oct. 1969 59 p refs Presented at the URSI 16th Gen. Assembly, Ottawa, 18 - 28 Aug. 1969 Submitted for Publ. Revised
(DI-82-0890) Avail: CFSTI

Extremely low frequency signals of 0.2 to 500 Hz were investigated. These magnetospheric signals are well below the minimum electron plasma and cyclotron frequencies, therefore, the hydromagnetic approximation applies. Although the magneto-ionic medium is anisotropic and inhomogeneous, the propagation theory for the fast and Alfven modes in homogeneous media is adequate at these frequencies. The morphology of these modes in remote regions of the magnetosphere is being developed from satellite studies. Studies based on ground observations have concentrated on dispersion, polarization, and amplitude analyses. Due to ionospheric attenuation, ground observations of ELF signals from the magnetosphere are limited to frequencies below about 10 Hz. In the band from 0.2 to 10 Hz many types of geomagnetic micropulsation signals were observed. Author

N70-11090# Naval Postgraduate School, Monterey, Calif.
ANALYSIS AND SYNTHESIS OF A TIME LIMITED COMPLEX WAVE FORM
Jerry Lee Post Dec. 1968 75 p
(AD-692440) Avail: CFSTI CSCL 17/7

The problem of analyzing time limited complex wave forms having time variant frequency domain characteristics is discussed. A bell tone is selected as a wave form to analyze and it is then synthesized to produce an approximation to the original sound. An electronic device is constructed to simulate all required fog signals for a sailboat, including a rapidly ringing bell. Author (TAB)

N70-11106*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
AN EXTREMELY THIN, OMNIDIRECTIONAL, MICROWAVE ANTENNA ARRAY FOR SPACECRAFT APPLICATIONS
Thomas G. Campbell Washington Nov. 1969 30 p refs
(NASA-TN-D-5539; L-6798) Avail: CFSTI CSCL 09F

The design and development of an extremely thin, omnidirectional, microwave antenna array, which is bonded circumferentially to the outside surface of a spacecraft and then coated with a dielectric material for thermal protection, is presented. This antenna was designed for a specific payload application in the S band (2200 to 2300 MHz) frequency range and provides an omnidirectional radiation pattern in the plane of the array and a near omnidirectional pattern in the planes perpendicular to the array. A procedure is presented whereby this design technique can be applied to other frequencies. Author

N70-11115# Naval Postgraduate School, Monterey, Calif.
AUTOMATIC VOLUME COMPENSATION FOR NOISY ENVIRONMENTS
Charles Randall Mc Gough (M.S. Thesis) Jun. 1969 84 p refs
(AD-692441) Avail: CFSTI CSCL 17/2

The importance of environmental noises which interfere with the audio output from the loudspeaker of an intercom or radio communications receiver has led to the study of sound masking and noise interference. The results are applied in the development of an automatic control system which compensates for environmental noises by maintaining the speaker output at a prescribed listening level above such interference. Such a system could be used to maintain the readability of communications in spite of a noisy environment such as on the bridge or in the engine room of a ship. Author (TAB)

N70-11154# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A LES-5 BEACON RECEIVER
T. S. Seay and A. H. Huntoon 1 May 1969 72 p refs
(Contract AF 19(628)-5167)
(AD-692437; TN-1969-27; ESD-TR-69-76) Avail: CFSTI CSCL 17/2.1

A functional description of a communications satellite beacon receiver is presented. The system, designed primarily for LES-5/6, is capable of reliable unattended operation, and provides a frequency and time reference for fixed and highly mobile satellite communications terminals. Theoretical and experimental data are given, with particular emphasis on automatic acquisition and tracking of the satellite beacon signal at low signal-to-noise-density ratios under adverse channel conditions. Author (TAB)

N70-11161*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRANSITION TRACKING BIT SYNCHRONIZATION SYSTEM Patent Application
Tage O. Anderson, inventor (to NASA), William J. Hurd, inventor (to NASA), and William C. Lindsey, inventor (to NASA) Filed 8 Jul. 1969 31 p
(Contract NAS7-100)
(NASA-Case-NPO-10844; US-Patent-Appl-SN-839934) Avail: CFSTI CSCL 17B

A bit synchronization system, incorporating a digital data transition tracking phase-locked loop is described. The system, to which an input signal in the form of a noise-distorted constant amplitude bipolar stream of data bits is assumed to be supplied, includes two integration channels. In one channel integrations are performed over assumed bit times, each bit time being equal to a bit period, while in the other channel integrations are performed over integration windows, each window being less than a bit period. The outputs of the two channels are combined to provide a pair of binary signals which are supplied to a digital filter, comprising a variable length counter and a variable gain register. The contents of the two registers are combined to provide an error signal indicative of the direction of the phase difference between periods of bits in said stream and the assumed bit times. NASA

N70-11235*# Pennsylvania Research Associates, Inc., Philadelphia.
COMPUTER GENERATION OF TELEVISION IMAGES: REAL-TIME SIMULATION OF LUNAR LANDSCAPE DISPLAYS
Joseph C. Mc Menamin May 1968 126 p refs
(Contract NAS8-21367)
(NASA-CR-102302) Avail: CFSTI CSCL 17B

The application of techniques for real time computer generation of television images to the visual display of a Lunar Surface Roving Vehicle (LSRV) simulator is reported. Many of the techniques have been known to simulation system designers for some time. This report outlines a system that combines known techniques of data representation and hybrid (analog – digital) computation with some very powerful and novel methods of electronic image synthesis. Although the techniques are specifically applied to the LSRV simulator, they are also useful in many other types of real time display generation. Included are the results of an effort to simulate in nonreal time the type of out the window displays which might be produced by the techniques described. Author

N70-11280*# Signatron, Inc., Lexington, Mass.
DELTA-MODULATION FOR THE TRANSMISSION OF IMAGE DATA Final Report
Leonard Ehrman and Herbert Gish 27 Aug. 1969 83 p refs
(Contract NAS12-2154)
(NASA-CR-86262) Avail: CFSTI CSCL 17B

This report deals with the application of delta-modulation digitization techniques to the efficient transmission of image data. The different forms of delta-modulators and a comparison on the basis of performance and complexity are presented. On the basis of these comparisons several types are recommended for experimental, high data rate, laboratory use. Also included is an extensive bibliography on delta-modulation which includes the most recent studies of both United States and foreign origin. Author

N70-11308# Informatics, Inc., Rome, N.Y.
COMMUNICATIONS COMPUTER LANGUAGE COMTRAN
David W. Clark, Charles W. Hoffman, and John E. Stannard Griffiss AFB, N.Y. RADC Jul. 1969 138 p
(Contract F30602-68-C-0204)
(AD-692171; RADC-TR-69-190; TR-69-1032-4) Avail: CFSTI CSCL 17/2

The purpose of this effort was to provide Rome Air Development Center with a communications-oriented compiler system which would accept statements in a language that would be convenient for test engineers, producing programs that would operate the test facilities computer in accordance with engineering requirements. The result of this effort is the COMTRAN System described in this technical report. The COMTRAN System accepts communication oriented statements of a very high level which describe a set of communication line units combined in such a manner as to constitute a real-time online communications test. A relatively small amount of source statements generate a complex communications test program complete with a real-time coordinating executive tailored to the immediate task. Error data resulting from execution of generated test program are passed through several report generators, or post processors. One or more of a set of fixed reports can be requested via parameter cards. The parameter cards are of a convenient format to the user engineers. The entire COMTRAN system is maintained on a single system tape by a versatile edit program. The COMTRAN system was designed with flexibility and future expansion in mind, however, several limitations are noted and discussed in this report. Author (TAB)

N70-11355 National Lending Library for Science and Technology, Boston Spa (England).
COMPATIBILITY OF PCM CODERS AND DECODERS USING DIFFERENT COMPANDING LAWS
M. Decina and L. Giacomelli 1 May 1969 30 p refs Transl. into ENGLISH from Note, Recensioni, Notiz., v. 17, no. 2, 1968 p 368–402
(NLL-PORS-Trans-2532-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: .3 NLL photocopy coupons

Results are reported of the calculation of signal to noise ratio and of the loss, in the case of connection, whether direct or through an optimum digital converter, between coders and decoders using different companding laws. An analysis has also been made of the compatibility between coders and decoders using the companding law $A = 87.6 - 13$ segments, whether digital or analogue and a different number of digits (7 or 8) distinguishing the two cases of codecs with and without "centre-clipping." Author

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N70-10059# Sandia Corp., Livermore, Calif.
DIGPOD: A PROGRAM FOR COMPUTING WEIGHT, CENTER OF GRAVITY, AND MOMENT OF INERTIA USING A COORDINATE DIGITIZER
H. Quock Nov. 1968 57 p
(PB-183841; SCL-DR-68-65) Avail: CFSTI CSCL 20K

A FORTRAN program (DIGPOD) has been written for finding the weight, center-of-gravity, and moment-of-inertia of surfaces which have a constant lateral cross section. By using a coordinate digitizer, information can be taken directly from early design layout drawings and the study completed in less than a day by persons relatively untrained in programming techniques. Author (USGRDR)

N70-10076 California Univ., Los Angeles.
GRAPH MODELS OF COMPUTATIONS IN COMPUTER SYSTEMS
Jean-Loup E. Baer (Ph.D. Thesis) 1968 223 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order No. 69-8109

The problems of a priori scheduling and predicting of performance of computer programs on multiprocessor computer systems are investigated. The model used is a directed bilogic graph, drawn from FORTRAN source programs, where vertices represent computational tasks and arcs represent transfer of control and/or data. This model shows the precedence constraints, concurrency or mutual exclusiveness between subtasks. The directed bilogic graph is transformed into a directed acyclic bilogic graph (d.a.b. graph). Extensions of existing mean path length algorithms for homogeneous systems and investigations of procedures for other types of multiprocessors are given. Sampling was performed in order to indicate the amount of distortion brought by these algorithms on five example graphs. A one-shot a priori scheduling with different urgency rules is presented. Experiments show that in general an a priori scheduling with urgencies, taking into account the global structure of the graph and the vertex attributes, behaves better (and never worse) than pure dynamic scheduling. Dissert. Abstr.

N70-10091 Syracuse Univ., N.Y.
A CLASS OF PARALLEL PROCESSING AUTOMATA
Vincent Carl Hamacher (Ph.D. Thesis) 1968 128 p refs
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-7744

A class of abstract machines called parallel processing automata (denoted PPA) which provides an alternative viewpoint to the concept of iterative arrays is proposed in an attempt to describe some of the properties of parallel computation by means of the simultaneous application of local functions on large arrays of data. A programming approach is presented for specifying the operations of the automata studied and its equivalence to the usual state transition function method is shown. The programming technique proves convenient in presenting examples of computations by the PPA class. Dissert. Abstr.

N70-10134* + Tuskegee Inst., Ala. School of Engineering.
ADAPTING AN AMTRAN TERMINAL TO GRAPHICAL NETWORK THEORY AND TO DEVELOP SOFTWARE FOR ADAPTING AMTRAN TO THE IBM 1620 COMPUTER
Michael R. A. Erdey 25 Aug. 1969 80 p refs
(Grant NGR-01-005-004)
(NASA-CR-106553) Avail: CFSTI CSCL 09B

Efforts to build an interface between the IBM 1620 computer and the NASA AMTRAN, develop and adapt graphical techniques to AMTRAN, prepare software for adapting the rectangular diagram method to the AMTRAN system, and provide programs for on-line interactive mathematical analysis are reported. The building of the interface was accomplished by simulation because fewer modifications to the computer would be required; 80% of the hardware in the AMTRAN terminal is completed. Electrical network analysis and the rectangular diagram method were applied to areas in materials science such as the elastic deformation of solids with the aid of laminated models. Three papers are included on: (1) simplified calculations for E based on composite models for concrete; (2) the rectangular diagram approach to determine the elastic deformations of non-linear n-phase composite solids; and (3) a graphical approach to determine the elastic deformation of linear n-phase composite solids. M.H.E.

N70-10151 National Lending Library for Science and Technology, Boston Spa (England).
THE MULTI-REGISTERS OF THE PERICLES-MICHELET AUTOMATIC EXCHANGE. PART 1: GENERAL STRUCTURE
P. Lucas et al 19 Jun. 1969 39 p refs Transl. into ENGLISH from Commutation et Electronique (France), no. 22, Jul. 1968 p 23–41
(NLL-PORS-Trans-2558-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: .4 NLL photocopy coupons

The programmed form of multiregisters which is a specialized computer for use in telephone systems is described. The stored program system is defined as one whose operation is governed by memory stored data. This permits flexibility which can be applied to local telephone exchanges, tandem exchanges, telephone centers, and data transmission centers. The fundamental characteristics, functions, and structure of the system are described. F.O.S.

N70-10161# New York Univ., N.Y. Inst. for Computer Research in the Humanities.
GRAMMATICAL RESTRICTIONS IN THE IPL 5 AND FAP STRING PROGRAMS, PART 1
Morris Salkoff and Naomi Sager Feb. 1969 113 p refs
(Grant NSF-GN-659)
(PB-184289; Rept-5-PT-1) Avail: CFSTI CSCL 05G

A description of the string program for syntactic analysis of English sentences, along with detailed descriptions of the mature and function of restrictions in a string grammar, is summarized. Author (USGRDR)

N70-10162# New York Univ., N.Y. Inst. for Computer Research in the Humanities.
GRAMMATICAL RESTRICTIONS IN THE IPL 5 AND FAP STRING PROGRAMS, PART 2
Morris Salkoff and Naomi Sager Feb. 1969 118 p refs
(Grant NSF-GN-659)
(PB-184290; Rept-5-PT-2) Avail: CFSTI
For abstract see N70-10161.

N70-10163# New York Univ., N.Y. Inst. for Computer Research in the Humanities.
GRAMMATICAL RESTRICTIONS IN THE IPL 5 AND FAP STRING PROGRAMS, PART 3
Morris Salkoff and Naomi Sager Feb. 1969 104 p refs
(Grant NSF-GN-659)
(PB-184291; Rept-5-PT-3) Avail: CFSTI CSCL 05G
For abstract see N70-10161.

N70-10185# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MINSK-222 GENERAL PURPOSE COMPUTER SYSTEM
E. V. Evreinov et al 24 Feb. 1968 14 p refs Transl. into ENGLISH from Vychislitelnye Sistemy (USSR), no. 23, 1966 p 13–20
(AD-692130; FTD-HT-23-169-68) Avail: CFSTI CSCL 9/2

The Minsk-222 universal computer system consists of a unidimensional system with a bilateral communication channel between the elementary machines. The number of elementary machines can vary from 1 to 16. Each elementary machine consists of the Minsk-2 or Minsk-22 digital computer and a system consisting of the following: an operation block and a device for switching the communication channels. TAB

N70-10289# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
DETERMINATION OF STATISTICAL CLUMPS
Marc Fogel May 1969 51 p refs
(Grant NSF-GN-682)
(PB-184136) Avail: CFSTI CSCL 05B

The exponential growth in the literature of most fields has produced a near crisis situation for the people who provide storage and retrieval facilities for this same literature. In his dissertation,

John Edwards describes a very useful tool for anyone interested in mechanizing the process of information storage and retrieval. One requirement of his system is that its vocabulary be divided into groups of words, each group representing a different sub-area of the initial field. It is the intention of the present paper to show why the problem of sub-dividing a vocabulary is best handled by computer. Of a number of existing techniques, one which seems appropriate is selected, modified, and certain improvements are suggested. The results described in this report are equally valid for any collection of objects – obeying a minimum set of requirements – which must be divided into smaller groups, the groups being defined in a statistical sense. USGRDR

N70-10311# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMATIC MACHINE FOR READING TYPEWRITTEN TEXTS
M. L. Avrukh, N. Ya. Birman, L. M. Magidson, V. P. Romanov, and G. I. Saenko 21 Jan. 1969 16 p refs Transl. into ENGLISH from the Russian
(AD-692143; FTD-MT-24-486-68) Avail: CFSTI CSCL 9B

An automatic reading machine is described. The equipment is designed to read typewritten texts in order to feed them into the Ural-4 computer when making literature survey problems and when processing certain forms of statistical information. The characters are recognized in this reading machine by a method which compares the unknown character with a set of fixed image field regions (the method of fragments). There is a block diagram of the system shown in the text. Tests have shown that the average reliability of this automatic reading machine is 0.995. TAB

N70-10343# Sandia Corp., Albuquerque, N. Mex.
A BOUNDED GEOMETRY LANGUAGE AND AN ASSOCIATED DATA MATRIX
J. H. Graham 1969 14 p Sponsored by AEC
(PB-184092; SC-DC-69-1825) Avail: CFSTI CSCL 09B

One is unable to explicitly define, for example a line segment or a rectangular patch of a plane, with a single statement in the APT geometry language, but there is no direct or formal means to provide the necessary linkage between the geometry and motion statements to obtain a well-defined bounded geometry language statement of a segment. The paper reports on a geometry language for defining explicitly geometrical entities. USGRDR

N70-10349# Gulton Industries, Inc., Albuquerque, N. Mex. Electronics Div.
INSTRUCTION MANUAL FOR SATELLITE ON BOARD ANALOG TO DIGITAL SYSTEM (SOBADS)
1968 62 p
(Contract Cwb-11190)
(PB-184179) Avail: CFSTI CSCL 09E

The satellite infrared spectrometer onboard analog to digital system (or SOBADS) is a system which accepts 9 analog signals and encodes these 9 analog signals sequentially in pure binary code and stores the data; then shifts it out sequentially. Each of the 9 channels are sampled and encoded in the first 100 milliseconds after the trailing edge of the nimbus sync pulse and again in the first 100 milliseconds 8 seconds after the nimbus sync trailing edge. The SOBADS receives a clock and a synchronizing signal from the nimbus B telemetry. Author (USGRDR)

N70-10386# Measurement Analysis Corp., Los Angeles, Calif.
PROGRAMMING AND ANALYSIS FOR DIGITAL TIME SERIES DATA
Loren D. Enochson and Robert K. Otnes Washington NRL 1968 -284 p refs
(Contract N0014-67-C-0073)
(AD-692735; SVM-3) Avail: CFSTI; Navy Publ. and Printing Service Office, Naval District Washington, Bldg. 157-2, Washington Navy Yard, Washington, D.C. 20390 $8.00

Contents: Preprocessing of data; Digital filtering; Fourier series and Fourier transform computations; Correlation function computations; Spectral density function computations; Frequency response function and coherence function computations; Probability density function computations; Nonstationary processes and Test case and examples. TAB

N70-10399 Stanford Univ., Calif.
STEADY-STATE HARMONIC ANALYSIS OF NON-LINEAR NETWORKS
Everett Minnich Baily (Ph.D. Thesis) 1968 175 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-8145

The analysis problem is formulated by expressing the time behavior of suitable network dynamic variables in Fourier series form and calculating the series coefficients. Multi-dimensional optimization techniques are used for finding the coefficients; an appropriate objective function for the optimization process is developed from the network differential equations. The differential equations, in turn, are established via a computer oriented scheme. Effectiveness of the analysis method is studied through its application to both linear and nonlinear networks. The surface of the optimization objective function for linear networks is shown to be convex; this strong result is used to predict successful behavior for some important types of nonlinear networks. Finally, a general digital computer program that incorporates the concepts of the analysis method is presented and used successfully for the analysis of several meaningful nonlinear network problems. Dissert. Abstr.

N70-10422# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
AUTOMATIC RECURSIVE ADDRESS COMPUTATIONS FOR ADVANCED COMPUTER LANGUAGES, ALGOL 68 IN PARTICULAR [AUTOMATISCHE REKURSIVE ADRESSENBERECHNUNG FUER HOEHERE PROGRAMMIERSPRACHEN, INSBESONDERE FUER ALGOL 68]
Ursula Hill (Ph.D. Thesis) 1969 114 p refs In GERMAN
Avail: CFSTI

Two significant optimization phases are contained in this method: the recursive calculation of addresses as such by addition of address differences to the last actual address; and by optimizations through identification of addresses or expressions and address possibilities via index registers. The first optimization method is not very efficient for one-dimensional fields, but it offers advantages for multi-dimensional fields and in particular for the algorithms of linear algebra. The second method is effective for all fields. Unlike other methods for addressing indexed variables, the present recursive address computation method is applicable to ALGOL 68 just as much as to ALGOL 60 and FORTRAN. Moreover, the present method is easier to implement with ALGOL 68 in simple models than, for instance, ALGOL 60. Transl. by K.W.

N70-10478# Bell Aerosystems Co., Buffalo, N.Y.
MAGIC: AN AUTOMATED GENERAL PURPOSE SYSTEM FOR STRUCTURAL ANALYSIS. VOLUME 2: USER'S MANUAL Final Report, 15 Mar. 1967 – 15 Mar. 1969
Stephen Jordan, Gene E. Maddux, and Robert H. Mallett Wright-Patterson AFB, Ohio AFFDL Jul. 1969 329 p refs
(Contract F33615-67-C-1505)
(AD-691893; AFFDL-TR-68-56-Vol-2) Avail: CFSTI CSCL 20/11

An automated general purpose system for analysis is presented. This system, identified by the acronym MAGIC for Matrix Analysis via Generative and Interpretive Computations, provides a

flexible framework for implementation of the finite element analysis technology. The subject document, Volume II, contains instructions for the preparation of input data and interpretation of output data with examples drawn from the applications presented in Volume I. Author (TAB)

N70-10485# Montana State Coll., Bozeman. Engineering Research Labs.

A CELLULAR COMPUTER TO IMPLEMENT THE KALMAN FILTER ALGORITHM

Lynn E. Cannon 14 Jul. 1969 235 p refs
(Contract N00014-67-C-0477)
(AD-692473; Rept-603-TL-0769; ERL-B-009-603) Avail: CFSTI CSCL 9/2

The subject of the report is the development of the design for a specially-organized, general-purpose computer which performs matrix operations efficiently. The content of the report is summarized as follows: First, a review of the relevant work which has been done with microcellular and macrocellular techniques is made. Second, the discrete Kalman filter is described as an example of the type of problem for which this computer is efficient. Third, a detailed design for a cellular, array-structured computer is presented. Fourth, a computer program which simulates the cellular computer is described. Fifth, the recommendation is made that one cell and the associated control circuits be constructed to determine the feasibility of producing a hardware realization of the entire computer. Author (TAB)

N70-10489# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

LINEAR HOMOGENEOUS DIGITAL CONTROL SYSTEM

Yu. K. Dmitriev et al 6 Dec. 1968 10 p refs Transl. into ENGLISH from the Russian
(AD-692132; FTD-HT-23-707-68) Avail: CFSTI CSCL 9/2

A linear digital control computing system with partially-variable structure is suggested for automation of scientific experiments; the system comprises a number of elementary control computers. One of the possible schemes of such a system tentatively offered in the article comprises the following parts: switching unit of each ECC; switch; scheme for controlling the switches; tuning register; information exchange; a conjunction of indicants omega which take part in ECC operation; generalized signal for information exchange; signal for subsystems joining; information line. In the above scheme, either an ECC or a combination of ECC's can operate as a control computer. Switching operations are explained in some detail. Author (TAB)

N70-10526# Illinois Univ., Urbana. Coordinated Science Lab.

THE ARCHITECTURE OF A LARGE DISTRIBUTED LOGIC ASSOCIATIVE MEMORY

Gerald J. Lipovski Jul. 1969 167 p refs
(Contract DAAB07-67-C-0199)
(AD-692195; R-424) Avail: CFSTI CSCL 9/2

The design of a processor for information storage and retrieval is considered. At the same time, the properties of a distributed logic stored program iterative associated processor are investigated. The capability to segment such a processor into independently acting units is clearly desirable. Two techniques for segmenting such a processor with a tree structure are presented here and are shown to make it economically promising for information retrieval. The tree structure is found to have short propagation delays so that a large processor might be feasible. The use of pushdown stacks in generating instructions in this processor is explored. The instruction set is improved somewhat over that of previous associative processors for more efficient retrieval. Considerable attention is given to representation structures which are particularly suited for describing complex data base. Author (TAB)

N70-10620# Joint Publications Research Service, Washington, D.C.

INVESTIGATING THE BEHAVIOR OF A STOCHASTIC AUTOMATION WITH VARIABLE STRUCTURE

V. M. Chentsov *In its* Inform. Networks and Commutation 27 Jun. 1969 p 55–59 refs (See N70-10816 01-07)
Avail: CFSTI

A transition probability matrix rule which varies with respect to columns is proposed for a stochastic automaton. The stochastic automation–environment system was simulated and the behavior of stochastic automata was compared by investigating the convergence of the average number of penalties to an asymptotic value. It was determined that stochastic automaton with a transition rule varying with respect to columns operates more optimally than the stochastic automaton with a rule varying with respect to elements. N.E.N.

N70-10684# Iowa Univ., Iowa City. Dept. of Mathematics.

NON-DETERMINISTIC AUTOMATA AND EFFECTIVE LANGUAGES

Stanley J. Walljasper Aug. 1969 131 p refs
(Contract N00014-68-A-0500; Proj. Themis)
(AD-692421; TR-17) Avail: CFSTI CSCL 5/7

In the dissertation, the concept of a finite automation is extended to a non-deterministic automaton over any arbitrary semigroup. The languages recognized by these non-deterministic automata are also characterized by regular expressions. Then a specific subclass of these automata is defined as deterministic automata which are characterized by congruences of finite index on the semigroup. The closure properties of these languages are then examined. In order to relate the languages recognized by non-deterministic automata to computable sets or formal languages, a specific type of computable semigroup called sigma-effective semigroup is introduced. Then associated classes of effective languages are defined. It is shown that for any sigma-effective semigroup one can constructively find another which is finitely generated such that the two effective languages are the same. TAB

N70-10724*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CINEMATIC–FORTRAN SUBPROGRAMS FOR AUTOMATIC COMPUTER MICROFILM PLOTTING

Robert G. Kannenberg Washington Nov. 1969 50 p
(NASA-TM-X-1866) Avail: CFSTI CSCL 09B

CINEMATIC is a collection of computer subprograms that gives the computer user easy access to graphic output of his results on microfilm. CINEMATIC subprograms are written in and used in FORTRAN 4. The computer user programs for film output in terms of what he wants to see on film rather than in terms of how the film recorder works. As a result, the structure of CINEMATIC does not depend on the particular film recorder used. Author

N70-10843# Boeing Scientific Research Labs., Seattle, Wash.

POST MORTEM PROGRAM FAILURE ANALYSIS IN A TIME-SHARING ENVIRONMENT

Rudolf Bayer Jun. 1969 23 p refs *Its* Inform. Sci. Rept. No. 33
(AD-692816; D1-82-0879) Avail: CFSTI CSCL 9/2

As background a brief review is given of post mortem program failure analysis (PMA) as implemented on second generation computer systems. Then the impact of some special characteristics of a time-sharing environment (TSE) on PMA is discussed, namely: continuous service to many users, sharing of programs and data, dynamic relocation, symbolic addressing, and elaborate protection schemes. General design principles for PMA operating within the framework of a deceased program are established, and some specific advantages due to the TSE are pointed out. Implications for the design of the operating system and the hardware of a TSE are

derived, namely, the need for a symbolic instruction counter of a symbolic page address register is demonstrated, and necessary more general protection mechanisms are proposed. Author (TAB)

N70-10891 National Lending Library for Science and Technology, Boston Spa (England).
SOME ASPECTS OF NEURAL LOGIC [NEKOTORYE VOPROSY NEIRONNOI LOGIKI]
D. I. Kirvelis et al Jul. 1969 22 p refs Transl. into ENGLISH from Vopr. Bioniki (USSR), 1967 p 163 - 173
(NLL-RTS-5151) Avail: Natl. Lending Library, Boston Spa, Engl.: 27s 6d

Mathematical notations of binary logic are used to derive corresponding operations in neural logic including the temporal characteristics of the input variables. It is postulated that the input to the neuron is the product sum of input and output value variations simulating the signals from neurons. The obtained neuron model is inertialess and has idealized linear characteristics with the threshold theta to be zero. Computer simulation of the neuron logic scheme showed that operating data did not differ fundamentally from theoretical predictions. As the factors increased, the properties of the scheme became more selective. G.G.

N70-10996# Georgia Inst. of Tech., Atlanta. Office of Information Science.
UDECOM A U 1108, PDP-8/I DATA COMMUNICATION SYSTEM
Franklin G. Peters 1969 27 p
(Grant NSF GN-655)
(PB-185399; GITIS-69-10) Avail: CFSTI CSCL 09B

The report outlines the development of the UDECOM system (UNIVAC-DIGITAL EQUIPMENT CORPORATION DATA COMMUNICATION SYSTEM). UDECOM is the implementation of a software package for the DEC PDP-8/I computer which enables data communication with the UNIVAC 1108 computer. The basis of the design is to use the PDP-8/I as a model of the UNIVAC 1004 remote system in the U1108/U1004 data communication environment. The UDECOM system is designed such that the PDP-8/I appears to the U1108 exactly as a U1004. Author (USGRDR)

N70-10997# Georgia Inst. of Tech., Atlanta. School of Information Science.
MANAGEMENT OF COMPUTER PROGRAMMING. PART 1: PRACTICES AND PROBLEMS
Gerald W. Gill and Alton P. Jensen 1969 23 p refs
(Grant NSF GN-655)
(PB-185470; GITIS-69-01) Avail: CFSTI CSCL 09B

The study investigates the management of computer centers, with emphasis on managing the programming effort. Problems and objectives of programming management are examined and techniques used in selected business and governmental organizations are presented. The data were collected by the case study method by surveying seven organizations. The particular aspects of the problem discussed in the report emphasize programming objectives and standards. Author (USGRDR)

N70-10999# Georgia Inst. of Tech., Atlanta. School of Information Science.
INFORMATION SYSTEMS IN UNIVERSITIES
Robert M. Siegmann 1969 91 p refs
(Grant NSF GN-655)
(PB-185398; GITIS-69-07) Avail: CFSTI CSCL 05B

The use of a digital computer as an aid to information processing is discussed at appropriate places in the exposition. The paper is structured around the theme of viewing a university as a totality of many diverse information systems which are interdependent and related to one another. The managerial revolution in higher education, the pressures from government and industry, and the increasing social demands on the university combine to form a favorable climate for a total systems approach to analyzing the university. The report reviews this environment, discusses and postulates conceptual designs for the major university information systems, and gives recommendations for what can be done now to begin to upgrade the processing of information in the university. The report ends with a short summary and a bibliography of articles and books which discuss topics germane to university information systems. Author (USGRDR)

N70-11001# Georgia Inst. of Tech., Atlanta. School of Information Science.
METHODOLOGY OF SYSTEM DESIGN: DEFINITIONS AND DIRECTIONS
Kay A. Mowery 1969 45 p refs
(Grant NSF GN-655)
(PB-185404; GITIS-69-04) Avail: CFSTI CSCL 05B

The constructive phases of system design are discussed with particular reference to information systems design. A preliminary attempt is made at definition of terms and an initial organization of research presented. A synopsis of work to date is presented within the framework of three thrust areas (1) creative and intuitive design methods, (2) formalisms for synthesis, and (3) existing methodology of information systems design and systems engineering. A structured bibliography is included. Author (USGRDR)

N70-11008# Georgia Inst. of Tech., Atlanta.
A SURVEY OF DISPLAY HARDWARE AND SOFTWEAR
Jesse H. Poore, Jr., Jay E. Davidow, and Donald P. Kelley 1969 48 p refs
(Grant NSF GN-655)
(PB-185408; GITIS-69-03) Avail: CFSTI CSCL 09B

The first report presents the fundamental principles of display hardware in terms of image generation from buffers presumed to be loaded and controlled by a digital computer. The concepts surrounding the electrostatic tube, the electromagnetic tube, and the charactron tube are discussed. Hardware characteristics of devices which allow interaction with a display system are also explained. The second report is concerned with the software aspect of operating display devices. Programming consideration (e.g. commands, interrupts, pen tracking) are discussed in general form rather than for particular devices. Data structures are then presented for expeditiously handling several geometrical forms that occur frequently in applications of computer graphics. Author (USGRDR)

N70-11033# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALGORITHMS FOR SELECTING DISCRIMINATION FRAGMENTS FOR A SET OF PRINTED CHARACTERS REPRESENTED BY STATISTICAL REFERENCE PATTERNS
M. L. Avrukh 2 Jun. 1969 25 p refs Transl. into ENGLISH from Russian Publ.
(AD-692157; FTD-MT-24-489-68) Avail: CFSTI CSCL 9/2

Two versions of an algorithm are described for selecting the discrimination fragments for a set of standard symbols represented by their statistical reference patterns. These algorithms have certain advantages over other algorithms because the use of discrimination fragments increases the possibility of discriminating between character parameters which are very similar but which differ in fine details. The use of statistical reference patterns lowers the requirements in regard to the quality of print and the exact position of the matrix with respect to the unknown character. It also makes it possible to unify characters which are printed in different style and are of different size (by reducing them to a common scale). TAB

N70-11108# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SIMULATION OF A ZERO-ADDRESS DIGITAL COMPUTER USING THE M-20 DIGITAL COMPUTER

G. M. Kolner 6 Jun. 1969 15 p refs Transl. into ENGLISH from Tsifrovaya Vychislitelnaya Tekhn. i Programmirovaniye (USSR), no. 2, 1967 p 56–65

(AD-692497; FTD-HT-23-1340-68) Avail: CFSTI CSCL 9/2

Some information is presented on the Soviet (adressless) digital computer with a magazine-type memory. A mathematical model of this computer is considered a program of simulating the adressless computer on a M-20 digital computer is described. Author (TAB)

N70-11116# Ohio State Univ., Columbus. Computer and Information Science Research Center.

USE OF WORD FRAGMENTS IN COMPUTER BASED RETRIEVAL SYSTEMS

D. S. Colombo and J. E. Rush Feb. 1969 18 p

(Grant NSF-GN-534-1)

(PB-184104; CISRC-TR-69-1) Avail: CFSTI CSCL 05B

Word fragments provide a means of simulating generic searching, and produce savings in search time (1) through a reduction in the number of search terms used and (2) by virtue of their smaller size relative to the words from which they were derived. The basic difficulty encountered in the use of word fragments as search terms is that of deciding just the right fragment to use. Author (USGRDR)

N70-11124# Georgia Inst. of Tech., Atlanta. School of Information Science.

THE LABORATORY FOR INFORMATION AND COMPUTER SCIENCE

Alton P. Jensen and Vladimir Slamecka 1968 12 p ref

(Grant NSF GN-655)

(PB-185471; GITIS-68-01) Avail: CFSTI CSCL 09B

The purpose and objectives of the Laboratory for Information and Computer Science of the School of Information Science, Georgia Institute of Technology, are described. A three year program of goals (1969–1971) is given. The equipment configuration of the laboratory centers around a versatile PDP-8/1 computer system, with the background support of the facilities of the Rich Electronic Computer Center of the Institute. Author (USGRDR)

N70-11132*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.

AN ASYNCHRONOUS BINARY ARRAY DIVIDER Patent Application

Gary Y. Wang, inventor (to NASA) Filed 1 Jul. 1969 18 p

(NASA-Case-ERC-10180; US-Patent-Appl-SN-838278) Avail: CFSTI CSCL 09B

An asynchronous binary array divider formed of an array of identical logic cells that can be utilized in a computer to perform binary division operations is described. Each cell includes a single bit binary subtractor and a selection gate. The array is connected to divisor, dividend, quotient and remainder registers. Divisor and dividend numbers are read into the divisor and dividend registers, respectively. The array of identical logic cells performs the division in parallel asynchronously and places the results of the division in the quotient and remainder registers for subsequent readout. The divider operates essentially simultaneously as opposed to sequentially thereby providing a rapid division operation without any control element. NASA

N70-11138# National Bureau of Standards, Washington, D.C.

USE OF A TIME-SHARED COMPUTER SYSTEM TO CONTROL A HALL EFFECT EXPERIMENT

W. Murray Bullis, W. R. Thruber, T. N. Pyke, Jr., F. H. Ulmer, and A. L. Koenig Oct. 1969 46 p refs

(NBS-TN-510) Avail: SOD $0.50

An experimental time-shared computer system has been used to control and collect data from a Hall effect experiment. In addition to selection of the voltage sequence and control of specimen current and magnetic flux directions, the computer exerts positive control over the specimen temperature in accordance with a series of thermocouple voltages entered by the operator at the beginning of the run. The interface circuitry is constructed from four general purpose modules and a single special purpose unit. Details of the interface system and the programs used to control the experiment and to perform intermediate calculations are given. It was found that the time-shared system was well-suited to control an experiment of this type. The demands on the computer were essentially similar to those required by a human user interacting in a conversational mode. Substantial savings in time over manual data collection and reduction were realized; a temperature run with 38 to 40 data points between 10 K and 320 K could be completed in less than 4 hours. Author

N70-11181*# Arizona Univ., Tucson. Dept. of Electrical Engineering.

MODIFIED OBSERVER SYSTEMS WITH REDUCED SENSITIVITY USING STATE VARIABLE FEEDBACK

Theodore L. Williams Jul. 1969 91 p refs

(Grant NGL-03-002-006)

(NASA-CR-106714) Avail: CFSTI CSCL 09B

Methods of design feedback control systems with both series and feedback compensators are outlined. The combined use of both series and feedback compensation provides more flexibility in the design than by using a single combination network. Using only series compensation, or open loop compensation without feedback, reduced the sensitivity of closed loop systems to plant variations below the values achieved with the combined series and feedback compensation method. Design and state variable feedback compensation are described and the design procedure for a modified observer system is discussed. Detailed descriptions of four numerical techniques are included as are three digital computer programs to facilitate required manipulations. G.G.

N70-11201# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.

EVALUATION OF PRINT READER OUTPUT CORRECTION STUDY Final Technical Report, 11 Apr. 1968–11 Apr. 1969

Arthur Mosher and Linda Strobel Jul. 1969 292 p refs

(Contract F30602-68-C-0239)

(AD-692521; IBM-I-8-4451; RADC-TR-69-197) Avail: CFSTI CSCL 9/2

This study has tested and evaluated a basic computer software model developed for assisting an optical character recognition unit in deciding character identity by context dependent factors. An operational environment textual data base was used for the study. It had errors introduced as a result of output from an optical character recognition device. Correction techniques used are based, not on full dictionary lookup, but on n-gram occurrence lists, common word dictionaries, environmental dictionaries, and character confusion tables. A conclusion of this evaluation is that the basic programmed model provides a reliable approach for correcting identified errors. It is flexible and accommodates adaptive or learning techniques and is most effective when information about the character in error is supplied by the device. Author (TAB)

N70-11283# Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Inst. für Flugführung.

CALCULATION OF THE AUTOCORRELATION FUNCTION AND ENERGY SPECTRUM WITH A DEC-PDP8 DIGITAL COMPUTER [DIE BERECHNUNG DER AUTOKORRELATIONSFUNKTION UND DES LEISTUNGSSPEKTRUMS MIT DEM DIGITALRECHNER DEC-PDP8]

Hans-Dieter Schenk Jun. 1969 50 p refs In GERMAN; ENGLISH summary
(DLR-Mitt--69-13) Avail: CFSTI

The increasing number of small computers as a research tool offers certain advantages to combine data acquisition and data analysis in the laboratory, particularly in those cases where a data link to a computer centre is not available. As a software support a program is developed according to existing methods for the calculation of the correlation function and the spectral power density distribution of experimental data. The program is written for the basic configuration of a DEC-PDP8 computer with a conversational input/output organization. Little training is required to use the program efficiently. Author (ESRO)

N70-11349# Iowa Univ., Iowa City. Dept. of Mathematics.
THE APPLICATION OF FAULT INDISTINGUISHABILITY IN COMBINATIONAL NETWORKS
James W. Gault Jul. 1969 97 p refs
(Contract N00014-68-A-0500)
(AD-692420; THEMIS-UI-TR-13) Avail: CFSTI CSCL 9/2

The desire is to reduce the dimensionality of test generation problems by removing sets of faults which are inherently indistinguishable prior to processing the network. Using these results computations are made to determine a fault detection test set using string manipulation and thus avoid the more difficult operations of symbol manipulation and simulation. Using the concept of indistinguishability, results are given for handling multiple as well as single faults. TAB

N70-11400# Rand Corp., Santa Monica, Calif.
AN ON LINE DEBUGGER FOR OS/360 ASSEMBLY LANGUAGE PROGRAMS
W. H. Josephs Aug. 1969 29 p
(Contract DAHC15-67-C-0141)
(AD-693089; RM-6027-ARPA) Avail: CFSTI CSCL 9/2

The paper gives a description of DYDE, an on-line debugging program for use by assembly-language programmers on third-generation IBM computers. The ability to debug a program on-line can mean a significant reduction in the programmers debugging effort. DYDE (Dynamic Debugger) provides the programmer with DDT-like capabilities of break-point insertion, modification of data and code, and symbolic-label references. It can operate under any option of OS/360, using only a small, user-written ping-pong SVC and communicating with the programmer by means of the 1052 operator's console (employing WTO and WTOR) or, preferably, the 2260 graphics console (using the OS Graphics Access Method support). TAB

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N70-10042*# Emerson Electric Co., St. Louis, Mo. Electronics and Space Div.
THE 400 MHz SCATTEROMETER Final Report
13 Oct. 1969 187 p ref Revised
(Contract NAS9-6742)
(NASA-CR-101976; Doc-2236) Avail: CFSTI CSCL 09E

A 400 MHz scatterometer system consisting of two aircraft assemblies: the antenna system and the receiver/transmitter unit is described. The primary mode of operation of the system is automatic where the pulse width, and the duty ratio of transmission are controlled by the radar altimeter. This is shown to allow complete reception of signals from target returns at all angles between ±60 degrees from the nadir. The antenna system is composed of two independent antennas: one for horizontal polarization, and one for vertical polarization. Following an RF transmission, each of the antennas is coupled to a receiver, and reflectivity measurements are made for the signals. The radar backscatter per unit area is obtained by data processing which takes into account antenna gains, beamwidth, transmitter power, target size, and altitude. F.O.S.

N70-10168# Stanford Univ., Calif. Microwave Lab.
MICROWAVE RESEARCH Final Report, 1 Nov. 1967 - 30 Jun. 1969
C. F. Quate, B. A. Auld, J. H. Collins, R. H. Pantell, and H. Heffner
30 Jun. 1969 282 p refs
(Contract Nonr-225-48)
(AD-691890; ML-1759) Avail: CFSTI CSCL 9/3

The results of work in the following areas are reported: Acoustic microscope; Electronic focusing in acoustic delay lines; Acoustic surface wave amplification; Two-step ultraviolet laser action; Submillimeter wave generator; Theory of thin film waveguides; and Electrostrictive acoustic amplifier. TAB

N70-10301# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
A DEVICE FOR HIGH VOLTAGE SURGE PROTECTION
E. J. Stearns 28 Aug. 1968 27 p
(PB-184651; WANL-TME-1849) Avail: CFSTI CSCL 13A

The memorandum presents a description of an electric furnace used to heat test specimens, and it describes furnace damage caused by electrical arcs when breaking specimen suddenly opens the inductive circuit. The device, which is applicable to any d-c circuit, provides a gap containing a dielectric material in parallel with the device to be protected. The gap is set to break down at a voltage well below the safe operating voltage of the device to be protected. A high voltage suddenly impressed on the parallel combination causes arcing across the gap and places a short circuit across the protected device. The current flow through the arcing circuit prevents further build-up of voltage to a level that might damage the protected device. Author (USGRDR)

N70-10316# Institute of Technology, Helsinki (Finland).
PUNCH THROUGH CONTROLLED SURFACE TO INCREASE BREAKDOWN VOLTAGE OF PLANAR p-n JUNCTIONS
Heikki Ihantola (Ph.D. Thesis) Swedish Acad. of Eng. Sci., Helsingfors 1969 35 p refs *Its* Phys. including Nucleonics Series no. 63
(PB-184607; APS-PH-63) Avail: CFSTI CSCL 20L

A new multiple ring (MGR) structure around the planar p-n junction is discussed. By using a controlled punched-through action between the guard rings, the surface limited and the junction curvature limited breakdowns can be avoided, and the device breakdown voltage can be made to approach the bulk breakdown of the plane p-n junction. The findings from numerous experiments have been classified, and the measured characteristics have been found to be in agreement with the presented theoretical model. The initiation of the punch-through action between the rings can be calculated; most of the other parameters are so manifoldly interrelated that their quantitative estimation was not attempted. Author (USGRDR)

N70-10338# GCA Technology Div., GCA Corp., Bedford, Mass.
SIGNAL PROCESSING FOR ARCAS FALLING SPHERE PROGRAM Final Report, 22 May 1967 - 30 Nov. 1968
John Dulchinos and Nicholas J. Guarino Jul. 1969 61 p
(Contract F19628-67-C-0218)
(AD-691892; GCA-TR-69-3-A; AFCRL-69-0216) Avail: CFSTI CSCL 9/6

Design has been completed for a rocket probe system which will determine air density at altitudes of 70 to 130 km. The design differs from that of similar probes presently being used for obtaining density measurements primarily in the signal processing electronics. It employs a digital processor which encodes 50 complete acceleration readings per second and generates a PCM output signal whereas previous probes have been analog in nature and have made use either of a multisubcarrier FM-FM system or a commutated signal subcarrier FM-FM system. In order to confirm the validity of the electrical design, a prototype unit has been fabricated and bench tested. Temperature tests have been performed on the prototype unit and indicate that over a 0 to 60C temperature range, an accuracy figure of plus or minus 0.1 percent has been achieved for the signal processing electronics portion of the probe system. This represents an order of magnitude improvement in accuracy over a typical FM-FM system. Power for the system is supplied by an internal battery pack consisting of seven rechargeable nickel-cadmium cells which have a capacity sufficient to operate the probe system for a duration of 40 minutes at room temperature.
Author (TAB)

N70-10351# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
STEP RECOVERY DIODES IN FREQUENCY MULTIPLIERS [STEP-RECOVERY-DIODEN IN FREQUENZVERVIELFACHERN]
Heinrich Armbruester (Ph.D. Thesis) 1969 22 p refs In GERMAN
Avail: CFSTI

The dependence of losses and transient behavior on the physical parameters, circuitry, and input frequency of frequency multiplier diodes was determined. With minor adjustments, the calculation methods that were developed can also be used to compute the performance of frequency dividers. The causes of various instabilities occurring in frequency multipliers and affecting their efficiency were also examined. Methods for correcting these instabilities are described. Results obtained by digital computation were verified by measurements on a frequency multiplier triode and on the model of a frequency multiplier.
Transl. by K.W.

N70-10385# Cincinnati Univ., Ohio.
PERFORMANCE AND APPLICATIONS OF A COLD CATHODE SOFT X-RAY SOURCE
James S. Solomon and William L. Baun Jun. 1969 44 p refs
(Contract F33615 67-C-1565)
(AD-692107: AFML-TR-69-41) Avail: CFSTI CSCL 9/1

The design and principles of operation of a cold cathode soft x-ray source are described for the production of soft x-rays. The source is versatile, very simple, and may be powered by either AC or DC high voltage power supplies. Discharge control is achieved with a fine metering valve or a commercially available Automatic Pressure Controller (A.P.C.). Measurements of x-ray stability and intensity were made with a continuously bending mica crystal spectrometer and electronics linked to a teletype system. Al Kalpha intensity as high as 71,420 counts per second was recorded. X-ray stability with a fine metering valve to control the discharge is fair for the first two or three hours of operation. With an A.P.C. the stability is greatly improved. The count rate is shown to have an average standard deviation of plus or minus 1% or less for the first hour of operation and no greater than 1.5% for longer periods of time (2 to 24 hours). Applications of the cold cathode source are shown for x-ray emission spectroscopy, soft x-ray radiography, and x-ray diffraction of long chain organic materials.
Author (TAB)

N70-10387 Pittsburgh Univ., Pa.
MATHEMATICAL ANALYSIS OF THE PROPERTIES OF FIELD EFFECT TRANSISTORS WITH SIMPLE GEOMETRICAL FORM
Kwang-ta Huang (Ph.D. Thesis) 1967 174 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-4436

The geometrical form and the physical properties of the transistor are taken as follows: The transistor has a rectangular cross section from source to drain. The third dimension is very large compared with the dimensions of this cross section. The transistor's physical properties as well as the applied voltages are designed to be independent of the third dimension so that the mathematical treatment can be reduced to a two dimensional problem. With these boundaries a mathematical solution of the voltage distribution is obtained, then a criterion is employed to test the electrical field on the boundaries and, if necessary, to adjust the boundaries. The procedure is iterated until the boundaries are located within a predetermined error. From this final solution of the voltage distribution, the operating characteristics of the transistor are derived. An example is solved for an uniformly doped, symmetrical gate transistor with the same gate voltages. The method for solution for different potentials on the gates and with nonuniform impurity density in the source drain channel is described but no examples worked.
Dissert. Abstr.

N70-10420 Tennessee Univ., Knoxville.
A STUDY OF THE THEORETICAL AND PRACTICAL LIMITATIONS FOR ENERGY DETERMINATION USING PULSE-AREA SENSING IN THE PRESENCE OF COLLECTION-TIME VARIATIONS
Joseph Alvin Connelly (Ph.D. Thesis) 1968 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-7143

The principal objectives were to theoretically justify the use of the pulse area-to-amplitude conversion technique for energy determination in the presence of charge collection-time variations; to extend the pulse area concept to a generalized filter, and to specifically apply AAC to single delay-line, single and double RC filter networks; and to experimentally verify the theoretical conclusions of the area-to-amplitude conversion technique. Requirements of a generalized filter for use with AAC were derived. Equations predicting the expected resolution error as a function of resolving time were derived. Comparisons were made between the conventional peak-amplitude technique of pulse-height analysis and AAC. The AAC technique produced a significantly smaller error. Particular emphasis was placed upon the operational integrating circuit which utilized capacitive feedback around an operational amplifier.
Dissert. Abstr.

N70-10453# Stanford Univ., Calif. Inst. for Plasma Research.
A SURFACE CHARGE INDUCTION MOTOR
Soon Dal Choi Jul. 1969 107 p refs
(Contract Nonr-225(83))
(AD-691889: SU-IPR-319) Avail: CFSTI CSCL 9/3

An electromechanical force generation mechanism involving interaction between moving media and a TM mode wave was studied. No restrictions were imposed on the wave and medium velocities. The medium with finite conductivity was assumed to be homogeneous, isotropic and linear, and to move with a uniform velocity. A relativistic transformation of the electromagnetic fields was employed to transform the electromagnetic fields in the frame of reference in which the medium was stationary to the laboratory frame of reference in which all the measurements were made. The dominant force mechanism was due to the electric field acting on the surface charge on the interface between the conducting medium and the air gap. The time average force mechanisms with the TM mode waves turned out to be due only to the electric field interacting with free surface charge due to the conductivity of the medium but not to the field acting on polarization charge. The theoretical efficiency of the electromechanical energy conversion of

this type of waves was found to be identical with that for the conventional induction motor. To check the theory a surface charge induction motor whose rotor was made from a hollow cylinder of a dielectric material was built. The TM mode was generated with a 60 Hz three-phase circuit constructed from a set of uniformly spaced wires fed in groups of three. Speed and torque data agree with an analysis of the space harmonic fields produced by such a circuit. The device operated as a motor both in the forward and backward directions and above and below the synchronous speed of the fundamental wave. Author (TAB)

N70-10500*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN EVALUATION OF TERMI-POINT CONNECTORS
17 Nov. 1969 41 p refs
(NASA-TM-X-53967; IN-R-QUAL-66-28) Avail: CFSTI CSCL 09E

This report is a statistical evaluation of termi-point connectors and their adequacy for use in ground support equipment. Tests performed included vibration, physical shock, salt spray, gas seal, thermal shock, and humidity. Suitability for the intended purpose was demonstrated; however, it was felt that in certain critical areas and for flight conditions, a more dynamic test program should be conducted. Author

N70-10536# Army Foreign Science and Technology Center, Washington, D.C.
A FERRO-TRANSISTOR PROGRAM TIME-DELAY RELAY
A. I. Finkel 20 Aug. 1969 10 p refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 1, 1967 p 53–54
(AD-692363; FSTC-HT-23-369-69) Avail: CFSTI CSCL 9/5

The article describes the design and operation of a time delay relay based on the use of ferro-transistor elements and which provides for a time delay range of one second to 24 hours. The complete electrical diagram of the device is included and a step-by-step analysis of the relay circuit is given. TAB

N70-10621# Joint Publications Research Service, Washington, D.C.
THE PROBLEM OF RESPONSE TIME OF A REED CONTACT
A. A. Vitkova *In its* Inform. Networks and Commutation 27 Jun. 1969 p 60–63 refs (See N70-10616 01-07)
Avail: CFSTI

The response time of reed-shaped metal contacts used with inductance coils is calculated. The components of the response time are identified as the build-up time of the magnetic field of the coil and the time required by the contacts to make contact. The time for the magnetic field to penetrate the contacts is considered to be the essential factor in the second time component. N.E.N.

N70-10651# Technische Hochschule Munchen (West Germany) Fakultat fuer Allgemeine Wissenschaften.
POTENTIAL FLOW IN A TWO-EMITTER DIODE [POTENTIALVERLAUF IN DER ZWEI-EMITTER-DIODE]
Manfred Troppman (Ph.D. Thesis) 1969 66 p refs In GERMAN
Avail: CFSTI

The shock free theory of a two emitter diode is studied and the diversity of obtained solutions is discussed. Applicable physical parameters are used to derive a singular distribution with a constant plasma potential for each diode operation. Existing oscillatory solutions disappear already at weak ionic shock probabilities. Potential distribution measurements are confirmed by electron beam measurements. Transl. by G.G.

N70-10676# Technische Hochschule, Darmstadt (West Germany). Fakultät für Elektrotechnik.
SIMULATION OF GROUNDING IN SMALL MIDDLE VOLTAGE NETWORK LINES WITH INSULATED Y-CONNECTION [NACHBILDUNG VON ERDSCHLUESSEN IN KABELN KLEINER MITTELSPANNUNGSNETZE MIT ISOLIERTEM STERNPUNKT]
Karl Ruppel (Ph.D. Thesis) 5 Jul. 1968 92 p refs In GERMAN Sponsored jointly by Deut. Forsch. Gemeinschaft, Hess. Elec. AG, and Dominitwerke
Avail: CFSTI

Causes and consequences of faulting of power lines are described, the mechanisms of breakdown of the cable explained and the influence of Y-connection emphasized. Tests with 20 kV cables representing a small network are presented, the results discussed and compared with arc discharge in free atmosphere. Special attention is devoted to materials which are sensitive to overload. ESRO

N70-10703# Sylvania Electric Products, Inc., Woburn, Mass.
DIELECTRIC FILMS AS CROSSPOINTS IN SWITCHING MATRICES Final Report, Jan. 1968–Mar. 1969
Pei Wang and Ned Van Buren Griffiss AFB, N.Y. RADC Jul. 1969 83 p refs
(Contract F30602-68-C-0159)
(AD-692170; RADC-TR-69-185) Avail: CFSTI CSCL 9/1

A critical evaluation was made of conductor-thin insulator film-conductor structures as practical bi-stable switching elements. More than a dozen of the materials considered promising for this purpose were used to fabricate metal-thin dielectric film-p silicon (ohmic back contact) test devices. The only ones capable of repetitive switching and having a high off/on resistance ratio are silicon oxide, silicon nitride, aluminum oxide and silicon nitride-on-silicon oxide films. Under properly chosen conditions, the test device switched via selfhealing breakdown, but since a current pulse was used to switch it off, Joule heating is unavoidable and a local erosion of the electrode does result. Therefore, the switching process is destructive, although the device may function for many cycles. The inference of electrode destruction, drawn from electrical and visual observation of devices under test, was supported by scanning electron microscopic examination of devices during self-heal breakdown, and by phase contrast microscopy, plus conductance and capacitance of the devices after SEM studies and after electrical evaluation. Experiments were performed to introduce impurities during device fabrication, with the hope that different modes of switching in these films would result. However, we failed to detect any significant changes. Author (TAB)

N70-10706# Naval Postgraduate School, Monterey, Calif.
ON FAULT IDENTIFICATION OF LINEAR NETWORKS
James Richard Dyer (M.S. Thesis) Jun. 1969 60 p refs
(AD-692445) Avail: CFSTI CSCL 9/5

A study has been made on the possibility of identifying faulty components of a network by making tests only on external points of that network. The conclusion is made that this is possible, and that a practical method of doing this can be developed from the computer program presented as a result of this investigation. The method used is to select the voltage transfer functions of a network as the quantities on which the tests will be made. The poles and zeros of these functions are used to select a set of test frequencies. From the measurements made at these frequencies, a set of signatures is available which allow the faulty components to be identified. Author (TAB)

N70-10719# Philips Zentrallaboratorium G.m.b.H., Hamburg (West Germany).
DEVELOPMENT AND CONSTRUCTION OF A DIGITAL LIGHT BEAM DEFLECTOR FOR SPACE APPLICATION

(SHORT TITLE: DIGITAL LIGHT DEFLECTION) [ENTWICKLUNG UND BAUEINES DIGITALEN LICHSTRAHLABLENKERS FUER ANWENDUNGEN IN DER RAUMFAHRT (KURZFASSUNG: DIGITALE LICHTABLENKUNG)]

U. Schmidt and W. Thust Jul. 1969 59 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.
(BMWF-FB-W-69-25) Avail: CFSTI

The development of a high-frequency, precision laser beam deflector would significantly improve the application of lasers in space research. The usefulness of such a deflector is largely dependent upon its size and weight. In principle, an electrooptic digital light beam deflector meets these requirements. The particular technique which is being investigated makes use of nitrobenzene Kerr cells and birefringent calcite prisms. The report describes the first high-frequency 10-stage digital light beam deflector. Author (ESRO)

N70-10720# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Stuttgart (West Germany). Inst. für Energiewandlung und Elektrische Antriebe.

THERMIONIC CONVERTERS WITH MIXED VAPORS. PART 1: METHOD, FUNCTION AND TECHNOLOGICAL PROBLEMS [THERMIONISCHE MISCHDAMPFKONVERTER. TEIL 1: PRINZIP, FUNKTION UND TECHNOLOGISCHE PROBLEME]

R. Hanne Jun. 1969 58 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-40; DVL-876) Avail: CFSTI

The cesium vapor pressure required for optimum operation of a thermionic cesium converter can be reduced considerably by addition of a second metal vapor (in this case barium). Plasma losses can thus be diminished, the efficiency increased and the interelectrode gap enlarged, which results in a higher constancy of performance. On the other hand the use of barium creates new problems because of its chemical activity and the higher temperatures of the converter compounds now required. Investigations, results and experiences are described concerning the behavior of several materials exposed to barium vapor intended for the use in barium cesium converters. Author (ESRO)

N70-10734# Harry Diamond Labs., Washington, D.C.

LOW TCC CAPACITORS FOR CIRCUIT APPLICATIONS

William E. Isler and Lester A. Kitchman Apr. 1969 25 p refs
(AD-692430; HDL-TR-1431) Avail: CFSTI CSCL 9/1

To meet requirements for temperature-stable components, an investigation into the temperature-dependence of capacitor dielectrics was undertaken. A review is given of the Gevers-du Pre theory of amorphous dielectrics, and its findings are examined for applicability to amorphous films of silicon monoxide (SiO). Films of SiO were deposited onto borosilicate glass substrates at rates ranging from 54 to 133 A/min. The values of the TCC showed a strong dependence upon the deposition rate; both negative and positive values were obtained--the former for the slower rates of deposition. All the TCC data agreed qualitatively with the Gevers-du Pre theory, which suggests that the negative TCCs are due to large expansion coefficients and low film densities obtained at slow deposition rates. The results of the present study also suggest that zero TCCs are possible and should occur at a rate near 68 A/min. Author (TAB)

N70-10737# Army Foreign Science and Technology Center, Washington, D.C.

A SILICON-TRANSISTOR DIGITAL CONVERTER NULL ELEMENT (A VOLTAGE-TIME CONVERTER)

N. I. Schedrov 20 Aug. 1969 14 p refs Transl. into ENGLISH from Prom. Telekhanika (USSR), no. 2, 1966 p 77-82
(AD-692535; FSTC-HT-23-368-69) Avail: CFSTI CSCL 20/5

This article describes the design and principles of operation of a transistorized and thermally-compensated voltage-time converter which operates in the input range from 0-2500 mv with an output of 1-11 m/sec. TAB

N70-10821# Colorado Univ., Boulder. Dept. of Electrical Engineering.

SYNTHESIS OF HIGH SPEED HOMOPOLAR ALTERNATORS AND THEORY OF SOLID ROTOR ELECTRICAL MACHINES, PHASE DD. PART 3: THEORY OF SOLID ROTOR MACHINES, APPROXIMATE ANALYSIS Final Report

Bedrich Heller Mar. 1969 72 p refs
(Contract DA-44-009-AMC-787(T))
(AD-691146) Avail: CFSTI CSCL 9/3

The performance characteristics of high speed, aerospace induction motors is analyzed. In order to obtain an explicit solution, the magnetic characteristic is represented as a straight line whose slope is a tangent to the saturated region of the real characteristic. The line intersects the B axis so that there is an infinite permeability at zero magnetic intensity. Formulae are derived for the penetration of the magnetic flux in the nonlinear rotor iron, and the magnetic densities. The currents are then estimated in the rotor. From these the torque at a given slip is calculated. The method is checked with experimental results. These calculations are based on measured airgap flux densities and not on calculated ones. Under these conditions theoretical and experimental results agree within seventeen per cent. Author (TAB)

N70-10822# Aerospace Corp., El Segundo, Calif. Electronics Research Lab.

STATE-OF-THE-ART STUDY OF SOLID-STATE MICROWAVE GENERATORS

Malcolm Mc Coll 31 Jan. 1969 61 p refs
(Contract F04701-68-C-0200)
(AD-691234; TR-0200(4230-13)-3; SAMSO-TR-69-203) Avail: CFSTI CSCL 9/1

The report presents a survey of the state of the art of solid-state microwave generators operating at frequencies in the range 1 to 100 GHz as reported in the literature as of 1 September 1968. The devices discussed include avalanche transit-time diodes, Gunn effect diodes, limited space-charge accumulation diodes, transistor oscillators, varactor multipliers, and tunnel diode oscillators. The basic physical principles of operation of the avalanche transit-time, Gunn, and LSA diodes are presented in some detail. The continuous-wave output powers available from varactor harmonic generators are shown to predominate in the range of 1 to 10 GHz. In the frequency range 10 to 100 GHz, the avalanche transit-time diode is presently superior to its competitors, especially in continuous-wave operation. Author (TAB)

N70-10830# Naval Postgraduate School, Monterey, Calif.

A TOPOLOGICAL APPROACH TO FAULT ISOLATION

James Dewey Courville (M.S. Thesis) Jun. 1969 164 p refs
(AD-692456) Avail: CFSTI CSCL 9/5

A method is developed for determining by simple external measurements faulty components of passive networks without mutual inductances. A program has been written using topological relationships to calculate the necessary fault isolation reference data. Computation time and storage requirements have been maintained at a minimum. Author (TAB)

N70-10837# Oak Ridge National Lab., Tenn.

AN OVERLOAD CANCELLATION CIRCUIT FOR A CHARGE-SENSITIVE PREAMPLIFIER

M. M. Satterfield, G. R. Dyer, and W. J. McClain 10 Jul. 1969 20 p Submitted for publication Prepared for Union Carbide Corp.
(Contract W-7405-eng-26)
(PB-185359; ORNL-TM-2654) Avail: CFSTI CSCL 18D

An active circuit which prevents saturation due to overloads in a charge-sensitive preamplifier is presented. Cosmic rays often produce relatively bright scintillations in a detector, especially if the crystal is large. The resulting overload may saturate the preamplifier, significantly increasing the dead time of the system. To reduce this undesirable effect, an active stage containing a field-effect transistor is inserted in parallel with the normal feedback network of the charge-sensitive preamplifier. This stage prevents an excessive charge from being deposited on the feedback capacitor and thereby prevents blocking in the preamplifier and permits a prompt return to linear operation. A description of the operation of the circuit and results of tests are included. Author (USGRDR)

N70-10855# Army Foreign Science and Technology Center, Washington, D.C.

A TIME SENSOR BASED ON FERRO-TRANSISTOR CELLS FOR PROGRAM CONTROL DEVICES

G. N. Pyrkh 20 Aug. 1969 11 p refs Transl. into ENGLISH from Tr. Soves Soveshch., Pt. 1 (Moscow), 1966 p 206–208

(AD-692633; FSTC-HT-23-370-69) Avail: CFSTI CSCL 9/5

For the automatic control of production processes, the author points up the advantages of using ferrotransistor cells operating on a decimal augend system of pulses. He discusses the elements composing a ferrotransistor cell-based instrument, their functions and operations, the instruments feed source, and its monitoring. TAB

N70-10871# Technische Hochschule, Darmstadt (West Germany). Inst. für Hochspannungs- und Messtechnik.

INFLUENCE OF INCOMPLETE SHIELDING ON BREAKTHROUGH AND PARTIAL BREAKTHROUGH OF POINT TO PLATE AIR GAP [DER EINFLUSS EINER UNVOLLKOMMENEN SCHIRMUNG AUF DEN DURCHBRUCH UND TEILDURCHBRUCH EINER SPITZE-PLATTE-STRECKE IN LUFT]

Volkmar Sienknecht (Ph.D. Thesis) 12 May 1967 75 p refs In GERMAN

Avail: CFSTI

Shields of insulating material are used to augment the resistance to air discharge of electrodes in liquid or gas dielectrics. It appears, however, that a hole in the shield can reduce the voltage at which the discharge occurs. This phenomenon is discussed together with the existence of predischarge and its relation to the breakthrough voltage. ESRO

N70-10987# Army Foreign Science and Technology Center, Washington, D.C.

THERMORESISTORS

24 Jun. 1969 23 p Transl. into ENGLISH from Russian State Standard Cost 10688-63 Feb. 1967

(AD-691976; FSTC-HT-23-775-68) Avail: CFSTI CSCL 9/1

The document establishes standards for the manufacture, testing, storage, packing and transportation of thermistors. Detailed specifications in tabular and schematic form show the authorized physical configurations and basic electrical parameters for thermistors of standard design. Technical test criteria are outlined, including authorized deviations from established standards. TAB

N70-11002# Bendix Corp., Kansas City, Mo. Kansas City Div.

AN EVALUATION OF SCATTERING PARAMETER TECHNIQUES AS APPLIED TO FIELD EFFECT TRANSISTOR CHARACTERIZATION

John Roger Lembke (M.S. Thesis) 1969 93 p refs

(Contract AT(29-1)-613)

(PB-185373; BDX-613-119) Avail: CFSTI CSCL 09A

The analysis of transistors as linear circuit elements can conveniently be accomplished by treating the transistor as a two-port network and then characterizing that network under small-signal conditions by use of a two-by-two matrix. The elements of the matrix are parameters completely defining the voltage-current relationships of the two-port network of any one frequency. The use of scattering, or s, parameters has been suggested. Developments in electrical instrumentation have made the measurement of scattering parameters practical and convenient, and it has been claimed that scattering parameter characterization offers certain advantages over other types of characterization. It was the purpose of the study to evaluate the advantages claimed for scattering parameters, and to determine the applicability of the scattering parameter measurement technique to the measurement of field effect transistor parameters. Author (USGRDR)

N70-11009# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HYDRAULIC ELEMENTS IN CONTROL SYSTEMS

I. M. Krassov 18 Jun. 1969 233 p refs Transl. into ENGLISH of the book 'Gidravlicheskiye Elementy v Sistemakh Upravleniya', Moscow, Mashinostroyeniye Press, 1967 p 3–226

(AD-692632; FTD-HT-23-1179-68) Avail: CFSTI CSCL 13/7

Special features and static and dynamic properties of hydraulic elements are discussed and their possible field of utilization established. Considerable attention is given to hydraulic amplifier-actuating mechanisms and their connection to power supply sources, and to an analysis of their energetic possibilities. This makes it possible to calculate the basic parameters of hydraulic systems if the technical requirements set forth are known. The above problems are discussed mainly as they apply to general-purpose automatic control systems. Current trends in the development of control system elements are formulated. Author (TAB)

N70-11037# Army Aeromedical Research Unit., Fort Rucker, Ala.

REAL-EAR SOUND ATTENUATION CHARACTERISTICS OF CBS LABORATORIES' MARK 2 EARPHONE INCLOSURES

Robert T. Camp, Jr. and Ronald F. Kovacs Jul. 1969 29 p refs

(AD-693261; USAARL-70-2) Avail: CFSTI CSCL 9/1

The real-ear attenuation characteristics of the CBS Laboratories MARK II earphone inclosures were determined by standard procedures and equipment. The inclosures were mounted in an Army APH-5 helmet. The results of the tests show that the MARK II earphone inclosures do improve the attenuation characteristics of the APH-5 at frequencies from 75 to 500 Hz. Author (TAB)

N70-11088# Hewlett-Packard Co., Palo Alto, Calif.

INVESTIGATION OF SCHOTTKY BARRIERS FOR OPTICAL DETECTION AND CATHODIC EMISSION Final Report, 1 Feb. – 31 May 1969

Jerome Cohen, Juri Vilms, and Robert J. Arthur 30 Jun. 1969 44 p refs

(Contract F19628-69-C-0148)

(AD-691283; AFCRL-69-0287) Avail: CFSTI CSCL 9/1

This is the final report of a four-month project to pursue the investigation of two new applications of metal-semiconductor Schottky barrier diodes which began under a previous one-year contract. The subjects investigated are photoemission from Au-p-Ge and other low-barrier-height contacts, for possible application for infrared detection near 10 micrometers and cathodic emission into vacuum from ZnS-Ag-Cs contacts, for possible use as a cold cathode. Author (TAB)

N70-11089# Sandia Corp., Livermore, Calif. Experimental Test Div.

RESISTANCE EFFECTS ON THE PERFORMANCE OF MAGNETICALLY-DRIVEN FLYER PLATES

D. B. Nelson Apr. 1969 38 p
(Contract AT(29-1)-789)
(PB-183975; SCL-DR-69-34) Avail: CFSTI CSCL 14B

The kinetic energy and impulse of a magnetically-propelled flyer plate is shown to be very dependent on system resistance. A system representative of those presently in use is chosen as an example. Author (USGRDR)

N70-11091# Defense Documentation Center, Alexandria, Va.
COLLECTION OF TOPICS ON SEMICONDUCTOR DEVICES, VOLUME 1 Report Bibliography, Jan. 1963 – May 1969
Aug. 1969 234 p refs
(AD-692600; DDC-TAS-69-50-1) Avail: CFSTI CSCL 9/1

Selective references are presented on development, application and manufacturing methods of diodes(seniconductors), avalanche, tunnel and varactor diodes; crystal mixers, detectors and rectifiers; photoelectric cells; and transistors. Results of investigations on the effects of nuclear radiation on semiconductor materials, device surface layers, and devices are discussed, as well as junction effects in compound semiconductors, doping, and crystal growth. Author (TAB)

N70-11139# European Space Research and Technology Center, Noordwijk (Netherlands).
SURFACE AND BULK EFFECTS DUE TO SPACE RADIATIONS IN ELECTRONIC COMPONENTS
R. A. Reid *In* ESRO Proc. of the 6th ESRO Summer School, Vol. 4: Environ. and their Role in Spacecraft Technol: Radiation Effects Feb. 1969 p 5–46 42 refs (See N70-11138 01-29)
(ESRO-SP-43-Vol-4) Avail: CFSTI

Radiation is damaging to all types of component, but in most cases the critical level is higher than that actually experienced in space. Components using organic materials and semiconductors are the most vulnerable to damage by radiation. Semiconductor devices are prone to degradation of the parameters necessary for successful operation, both in the bulk of the material and at the surface of the device, the latter being due to effects within and on the protective oxide layer. The complete shielding effect of the body of the spacecraft is difficult to compute; and in all cases the decision to fly a component should be based on its known sensitivity to radiation and the radiation environment of the orbit into which it is placed. ESRO

N70-11148*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
A METHOD FOR SELECTIVE GOLD DIFFUSION OF MONOLITHIC SILICON DEVICES AND/OR CIRCUITS Patent Application
Ronald A. Cohen, inventor (to NASA) Filed 30 Jul. 1969 10 p
(NASA-Case-ERC-10072; US-Patent-Appl-SN-845972) Avail: CFSTI CSCL 09A

A method for preparing compatible switching and nonswitching amplifier devices/circuits and/or linear and digital logic circuits on the same monolithic chip of semiconductor material is disclosed. The disclosed method comprises the following steps: depositing a layer of silicon nitride over the top of the chip of semiconductor; selectively opening windows in the silicon nitride by conventional methods; evaporating a thin gold film over said silicon nitride; diffusing gold into areas of semiconductor material where silicon nitride was remove; etching off excess gold; and completing the structure using standard planar construction techniques. NASA

N70-11157 National Lending Library for Science and Technology, Boston Spa (England).
EXAMINATION OF THE TOLERANCE FACTORS OF A STUDIO PAL DECODER BY MEANS OF SIMPLE TEST SIGNALS [UEBERPRUEFUNG DER TOLERANZWERTE EINES STUDIO-PAL-DECODERS MIT EINFACHEN TESTSIGNALEN]
P. Albrecht and G. Holoch 1 May 1969 31 p refs Transl. into ENGLISH from Rundfunk-Tech. Mitt., v. 12, no. 3, 1968 p 97–107 In GERMAN and ENGLISH
(NLL-PORS-Trans-2502-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

Electronically produced test signals are used to test and adjust a Pal color television receiver so that the errors present can be shown separately on the viewing screen of the receiver. In checking a studio decoder, these signals can also be evaluated by oscilloscope. In detail, this concerns the measurements of phase errors in the synchronous detection, the measurement of amplitude and delay errors of the delay-line modulator, as well as measurements of errors after the synchronous demodulators. Overall assessment of the output signals is made by vector diagram. G.G.

N70-11184# Hawaii Univ., Honolulu.
SOME ADVANCES IN THE THEORY OF DISTRIBUTED NETWORKS
Bharat Kinariwala Jul. 1969 35 p refs Sponsored in part by the Aloha System
(Contract F44620-69-C-0030)
(AD-691886; A69-3; AFOSR-69-2008TR) Avail: CFSTI CSCL 9/5

Probably the most significant advances in Circuit Theory in recent years have been in the area of Distributed Networks. The developments in the general theory of distributed networks are reviewed as well as those consisting of sections of uniform lines. Attention is drawn to the theory of networks which deals directly with non-rational meromorphic functions of the complex frequency variable. Possible future extensions of the theory are also discussed. Author (TAB)

N70-11196*# Singer-General Precision, Inc., Glendale, Calif.
STUDY OF FAILURE AND RELIABILITY OF MICROELECTRONIC DEVICES Quarterly Report, 1 Oct.–31 Dec. 1968
14 Feb. 1969 11 p
(Contract NAS12-72)
(NASA-CR-86263; QR-13; Rept-2-0512) Avail: CFSTI CSCL 09A

During this reporting period, vibration, shock, fine and gross leak, and X-ray examination tests for surface defects of microelectronic devices were completed. Tables summarizing failures by device number are included. F.O.S.

N70-11243*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PULSE COUPLING CIRCUIT Patent Application
Janis M. Niedra, inventor (to NASA) Filed 11 Aug. 1969 15 p
(NASA-Case-LEW-10433-1; US-Patent-Appl-SN-849106) Avail: CFSTI CSCL 09A

A switch, such as a transistor, is interposed between a pulse generator and a winding of an inductor, a load being coupled to the inductor. The switch isolates the inductor from the pulse generator at the end of each pulse causing a partial cycle LC oscillation in the unductor to reset its core. A capacitor may be connected across the inductor winding. To dissipate some energy, a resistor may be connected in series with the capacitor. The voltage across the inductor winding may be limited by a diode and a zener diode serially connected across the winding. Critical damping of the LC oscillation is obtained by connecting the resistor and the capacitor in parallel with the zener diode. Two such circuits may be doubled up in back-to-back relationship to energize two individual loads or one single load. NASA

N70-11244*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
HIGH VOLTAGE PULSE GENERATOR Patent Application
David L. Pippen, inventor (to NASA) Filed 28 Jul. 1969 15 p
(NASA-Case-MSC-12178-1; US-Patent-Appl-SN-845365) Avail: CFSTI CSCL 09A

A high voltage spark generator having a controllable, fixed energy spark for testing flash and ignition characteristics of nonmetallic materials in a controlled gas environment is described. A storage capacitor connected in parallel with a zener diode produces a fixed-energy discharge under the switching control of a silicon controlled rectifier circuit. A ready lamp automatically energizes when the storage capacitor is fully charged and the circuit may be manually or automatically discharged to produce a fixed energy spark. The generator has the means for fixing an exact voltage across the storage capacitor and indicating the presence of such voltage by suitable signalling means. An automatic discharge control operates only when the proper spark producing voltage is present. NASA

N70-11288# Rohde and Schwarz, Munich (West Germany).
THE HYPERBOLIC TECHNIQUE FOR CONTACTLESS MEASUREMENT OF THE SURFACE OF LARGE PARABOLIC ANTENNAS [DAS HYPERBELVERFAHREN, EIN VERFAHREN ZUM BERUEHRUNGSLOSEN MESSEN DER LAGE RAEUMLICH VERTEILTER PUNKTE, INSBESONDERE ZUR FESTSTELLUNG DER OBERFLAECHENKONTUR GROSSER PARABOLSPIEGEL]
M. Schiller and E. Linhuber Jul. 1969 81 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fur Wiss. Forsch.
(BMWF-FB-W-69-27) Avail: CFSTI

Present methods for the measurement and routine checking of the surface tolerances of large parabolic antennas preface the description of a new procedure which avoids direct contact but provides a high degree of accuracy. This procedure can also be used for checking structures which are already in service and for obtaining control criteria for routine adjustments of large antennas composed of a number of sections. The basic application of the method is demonstrated by means of a model. The newly developed units are described and the obtainable accuracy is discussed. The article concludes with some observations on possible applications of the procedure, such as the measurement of foundations and dam walls. Author (ESRO)

N70-11308# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Solid State Physics Research Lab.
CONVOLUTION OF PHOSPHOR RESPONSES OCCURRING IN CASCADED IMAGE INTENSIFIED TUBES AND RELATED SUBJECTS Final Scientific Report
Radames K. H. Gebel May 1969 14 p refs
(AD-692740; ARL-69-0043) Avail: CFSTI CSCL 9/1

The convolution of the phosphor responses of several cascaded image convertor tubes is employed as an image time delay for gaining the time needed to operate threshold controllable gating devices designed to protect highly fragile television image transducer tubes, et., against randomly occurring highly intense light flashes, etc.; the protective gating also blanks out the flashes in the reproduced image and thus prevents kinescope recordings from being accidentally overexposed by these flashes. The blanking in the reproduced image may not be visually noticeable or, in the case of longer blanking durations, be much less annoying to the observer than the bright flashes. In a more sophisticated device, one may substitute blanked-out frames with the last undisturbed frame, utilizing a storage device. Typical overall responses resulting from the convolution of several phosphors, and a typical block schematic showing a protective arrangement which also is capable of frame substitution, are shown. Author (TAB)

N70-11399# Naval Civil Engineering Lab., Port Hueneme, Calif.
LOW FREQUENCY POWER TRANSIENT FILTERS
A. A. Mahmoud Aug. 1969 31 p refs Sponsored by Naval Civil Engineering Command
(AD-693086; R-636) Avail: CFSTI CSCL 9/5

Transients in electrical power systems at various military installations are reported to cause malfunctions in and damage to electronic equipment. Investigations to date indicate that harmful transients are injected into the critical power bus by both external and internal transient producers. Oscilloscope recordings show that the harmful transients consist of oscillatory voltages having predominant frequency components as low as 400 Hertz and high-frequency disturbances in the form of spike voltages as short as 10 microseconds in duration. A study was conducted on the feasibility of developing power filters which could prevent the externally produced transients from reaching transient-sensitive electronic equipment, and prevent load-caused transients from reaching the critical power bus. This report describes that study. Based on the findings, a three-phase filter was designed, fabricated, and experimentally evaluated. Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N70-10278 Tennessee Univ., Knoxville.
THE DEVELOPMENT OF TWO ALGORITHMS FOR THE ANALYSIS AND DESIGN OF LINEAR NETWORKS WITH A PIECEWISE-LINEAR APPLICATION TO A BASIC SCHMITT-TRIGGER CIRCUIT
Donald Ray Dunn (Ph.D. Thesis) 1968 157 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-7152

In this study, two algorithms were developed for the analysis and design of linear networks in the complex-frequency domain. In addition, computer-aided design techniques were applied to a switching circuit problem. In the first algorithm, two approaches were developed for calculating the poles and zeros of resistance impedance capicitance (RLC) networks by using a digital computer. The poles and zeros were derived from a set of state-variable equations or from the network's immittance matrix. In the second algorithm, a method was formulated for applying root-locus theory and digital computer techniques to the design of active-RLC networks. A root-locus plot was obtained as a function of a particular network element as the element was varied from zero to infinity. Computer-aided design techniques were used to study the limitations on the speed of response of a basic Schmitt-trigger circuit due to certain resistive elements. Dissert. Abstr.

N70-10459 Stanford Univ., Calif.
ON THE IDENTIFICATION AND CONTROL OF LINEAR SYSTEMS
Bhaskarpillai Gopinath (Ph.D. Thesis) 1968 124 p refs
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-8187

One of the most interesting areas in control theory is the study of linear systems—especially those which are time invariant. Two of the most important problems associated with linear systems are first, identification, namely, the problem of finding the parameters of the model from input/output data; the second problem is one of designing systems to control given systems. This dissertation studies some aspects of both these problems. The first part of the study is concerned with the structural properties of linear systems. For what seems to be the first time, some special properties of cyclic systems are analyzed in detail. It was found that a simple but important property of linear spaces is central to

the analysis of cyclic systems. This property is presented as a new lemma and used also in the design of controllers. Cyclic systems are a very large subclass of linear systems; in particular, they include all systems with distinct characteristic roots. Dissert. Abstr.

N70-10713*# Texas Univ., Austin. Electronic Materials Research Lab.
RESEARCH ON DIGITAL TRANSDUCER PRINCIPLES. VOLUME 10: THIN FILM TITANIUM DIOXIDE BY CHEMICAL VAPOR DEPOSITION, 1 JULY - 31 DECEMBER 1968
Dale R. Harbison, H. Lyndon Taylor, and William H. Hartwig 31 Dec. 1968 112 p refs
(Grants NGL-44-012-043; AF-AFOSR-786-76; NSF GK-1395)
(NASA-CR-106585) Avail: CFSTI CSCL 09C

The hydrolysis of titanium organometallics using hydrogen and carbon dioxide at 900 C forms a thin film of titanium dioxide with desirable properties. The frequency effects in the current - voltage curves of the dielectric differ for tetraisopropyl titanate and polymerized tetrabutyl titanate. The 1 kHz capacitance per unit area is 0.2 mu F/Sq cm for a 2000 A film on silicon. The dielectric constant of this film ranges from 50 on silicon to 80 on platinum. The dissipation factor ranges from 1 to 10 percent The breakdown strength is 5 times 100,000 volts/cm. Capacitance - voltage data on misstructures indicate an oxide space charge of approximately 10 to the 12th power states/sq cm with a flat band voltage of zero volts. Measurements of the change in voltage required to maintain the flat band condition as the temperature is lowered give a density of fast interface surface states of less than 10 to the 12th power states/ev sq cm. Shifts in current - voltage curves with gate electrode material and silicon dioxide - titanium oxide mixtures suggests promising device application. Current - voltage data indicate that the dominant conduction mechanism is Poole - Frenkel emission from donor and acceptor sites and traps within the bulk of the titanium dioxide film. The activation energy is 0.11 ev and the conduction barrier height is 0.25 ev. Author

N70-10778# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
A METHOD FOR SUB-OPTIMAL DESIGN OF LINEAR AND NONLINEAR CONTROL CIRCUITS [EIN VERFAHREN ZUR SUBOPTIMALEN AUSLEGUNG LINEARER UND NICHTLINEARER REGELKREISE]
Werner Wiesner (Ph.D. Thesis) 1969 36 p refs In GERMAN
Avail: CFSTI

Described is a method to form relative simple regulators by using variance calculations and optimal parameterization. Exact expressions for optimal control of linear systems are obtained by using Euler - Lagrange equations. Various optimal and sub-optimal realization possibilities are then discussed through application of a conjugate gradient method. Transl. by G.G.

N70-11204# Argonne National Lab., Ill.
FORCE-REFLECTING SERVOMECHANISMS WITH SIGNAL-TRANSMISSION TIME DELAY
William M. Thompson (Ph.D. Thesis—Ill. Inst. of Tech.) Sep. 1968 114 p refs
(Contract W-31-109-eng-38)
(ANL-7488) Avail: CFSTI

The absolute and relative stability of a force-reflecting servo-mechanism with time delay in the signal-transmission channels was investigated by several methods. One method used a stability criterion for time-lag systems due to Pontryagin. This criterion is adapted and extended for use in this study. The servomechanism provides the connecting links currently used, electrically connected, master-slave manipulators. The time delay is due to the time required for signals to traverse the distance between the master and slave arms, if they are separated by large distances. Two time delays of approximately 4 and 23 msec are used to illustrate the Pontryagin method. The latter delay corresponds to a separation distance of about 4000 miles. The analog-computer simulation of the system indicated that the stability is very sensitive to the values of gain in the signal-transmission channels. One objective was to determine the stable regions in gain-parameter space. Author (NSA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N70-10049# Road Research Lab., Crowthorne (England).
SOME MEASUREMENTS OF BRAKING FORCE COEFFICIENT ON SIX AIRFIELD TEST SURFACINGS
G. C. Staughton 1969 27 p refs
(PB-184170; RRL-LR225) Avail: CFSTI CSCL 01E

To access the skid-resistance in wet conditions of a range of airfield surfacings a series of tests was carried out on the runway at the College of Aeronautics, Cranfield. Locked wheel and peak braking force coefficients were measured for three concrete and three asphalt surfaces using the heavy load test vehicle fitted with an aircraft tyre. Two of the concrete and one of the asphalt surfaces had been grooved, another asphalt surface had been surface dressed to improve their skidding resistance. Author (USGRDR)

N70-10139# Control Data Corp., Rockville, Md.
ANALYSIS OF THE IMPACT OF 747 TYPE AIRCRAFT ON AIRPORT TERMINAL OPERATIONS USING A COMPUTER SIMULATION
Irv Chamberlain Apr. 1969 69 p
(Contract DOT-B-775)
(PB-183909) Avail: CFSTI CSCL 01E

The report contains the results of series of runs of an airport simulation model. This model simulates all activities (passenger and baggage movement, aircraft movement, and service personnel utilization) concerned with the operations of an airline terminal at Kennedy Airport. The model was developed during the period March 1968 through August 1968 for the Office of Systems Analysis of the Department of Transportation. Initial utilization of the model is to serve as an analytical tool to assess the impact of 747 aircraft upon the activities of the terminal; the terminal selected being representative of a facility that has only one airline as an occupant as well as being a 'terminal' facility in that all flights originate or terminate at the facility. An appendix contains a description of the model in detail. Author (USGRDR)

N70-10206# Peat, Marwick, Livingston and Co., Boston, Mass. Capitol Region Planning Agency, Hartford, Conn.
PRELIMINARY PLAN FOR AIRPORTS IN THE CAPITOL REGION
Hartford, Conn. Capitol Region Planning Agency May 1969 102 p refs Prepared for Capitol Region Planning Agency
(PB-184334) Avail: CFSTI CSCL 13B

Ten alternate plans are presented, each accompanied by evaluation criteria for a 29-town airport system for the Capitol Region of Hartford, Connecticut. It is recommended that the present runway configuration at Bradley International Airport can handle all projected commercial operations plus related general aviation activity provided that a publicly-owned system of six satellite airfields is developed to accommodate the bulk of new general aviation

growth in the Region. Results are presented of an airspace analysis involving various suggested principal runway alignments at the Region's major airport (Bradley International). An outline is given of suggested continuous planning policies in order to highlight potential problem areas with sufficient lead time so as to be able to anticipate, in a timely manner, the need for remedial action. Author (USGRDR)

N70-10207# Road Research Lab., Crowthorne (England).
TREATMENTS TO RETEXTURE A WORN CONCRETE SURFACE OF A HIGH SPEED ROAD
D. E. Weller and D. P. Maynard 1969 32 p refs
(PB-184174; RRL-LR250) Avail: CFSTI CSCL 13B

Experiments were carried out on a section of the M.1 motorway to determine the most suitable treatment to restore adequate skidding resistance to a worn concrete surface of a high-speed road. Measurements made during the initial 3 years of the experiment showed that treatments had improved the sideway-force coefficient at low speed (50 km/h) and that all the treatments markedly reduced the fall in skidding resistance shown by the untreated surface when the speed was increased to 130 km/h. The best overall results were given by a diamond pattern of narrow grooves and by wide transverse grooves; these were the most expensive methods tried but the cost would be considerably reduced if they were used on a commercial scale. Author (USGRDR)

N70-10235# Federal Aviation Administration, Atlantic City, N.J. Transportation Dept.
FRICTION EFFECTS OF RUNWAY GROOVES, RUNWAY 4R-22I JOHN F. KENNEDY INTERNATIONAL AIRPORT, PHASE 2 Final Report
William A. Hiering and Charles R. Grisel Jul. 1969 40 p refs
(AD-692075; FAA-NA-69-8(DS-69-3) Avail: CFSTI CSCL 1/5

Wet and dry runway friction tests were conducted on concrete Runway 4R-22L at John F. Kennedy International Airport, New York City, using a Fixed Slip Runway Friction Tester. These tests were conducted to determine if significant friction increases or decreases were generated as a result of transversely grooving the runway surface with 3/8-inch-wide, 45 deg., V-shaped grooves, having a 1 3/8-inch pitch. Data analysis indicates that at the test speeds of 50 and especially 60 mi/h, an appreciable increase in overall wet runway friction values due to grooving was obtained for these series of tests. In addition, the treatment of the runway surface by the cutting of uniformly spaced grooves markedly smoothed the resultant wet runway friction values. The chemical removal of rubber from the touchdown area of the 22 end of the ungrooved runway substantially improved the friction values of this end compared to those of the untreated 4 end. Author (TAB)

N70-10358*# Techtran Corp., Glen Burnie, Md.
ROLE AND SIGNIFICANCE OF THE NEW STAGE OF COOPERATION AMONG WARSAW PACT NATIONS IN THE FIELD OF SCIENTIFIC AND TECHNICAL INFORMATION [ROL'IZNACHENIYE NOVOGO ETAPA SOTRUDNICHESTVA STRAN-CHLENOV SEV V OBLASTI NAUCHNOY I TEKHNICHESKOY INFORMATSII]
A. N. Kuskov Washington NASA Oct. 1969 6 p Transl. into ENGLISH from Nauch.-Tekh. Inform. Vses. Inst. Nauch. Tekh. Inform., Ser. 1, no. 7, 1969 p 37-38
(Contract NASw-1695)
(NASA-TT-F-12687) Avail: CFSTI CSCL 05B

The planned International Center for Scientific and Technical Information is to be located in Moscow and will serve to coordinate and guide information services in all the Warsaw Pact nations. The center will coordinate translation of difficult languages, centralize information on library holdings, and perform research into information processes and equipment. Daily administration will be by the Russian director and his staff, with policy decided by representatives of the information systems of all member countries. Author

N70-10423# Aeronautical Research Inst. of Sweden, Stockholm.
FFA WIND TUNNEL FACILITIES. PART 1: SUBSONIC TUNNELS
1969 42 p refs
(FFA-Memo-60-Pt-1) Avail: CFSTI

The wind tunnel facilities of the Aeronautical Research Institute of Sweden (FFA) are described. Wind tunnels are available for static and dynamic testing of most types of aeronautical models over the entire range of low subsonic to hypersonic speeds. Auxiliary test rigs and special equipment are available for more intricate problems of aerodynamic testing. This report discusses the main low speed tunnel with accompanying power equipment and instrumentation, a smoke tunnel with horizontal and vertical contractions, and an icing tunnel for high altitude simulation. Instrumentation common to all the tunnels, such as strain-gage balances and calibration stands, data processing equipment, and design and workshop facilities, are also reported. R.B.

N70-10424# Aeronautical Research Inst. of Sweden, Stockholm.
FFA WIND TUNNEL FACILITIES. PART 2: TRANSONIC-SUPERSONIC TUNNELS
1969 76 p refs
(FFA-MEMO-60-Pt-2) Avail: CFSTI

A closed-circuit, continuous transonic tunnel with an octagonal test section is described. Five transonic-supersonic tunnels, which operate by sucking atmospheric air via a drier into a vacuum storage, and related equipment are discussed. The facility is also equipped with a blow-down to atmosphere trisonic tunnel of the continuously variable Mach number type having a semiflexible wall nozzle operated by a single screw mechanism. The air supply system for the trisonic tunnel is outlined. Data acquisition consists of up to 50 analog input channels, 6 external digital words and 30 digital constants; recording is in digital format. See also abstract N70-10423. R.B.

N70-10425# Aeronautical Research Inst. of Sweden, Stockholm.
FFA WIND TUNNEL FACILITIES. PART 3: HYPERSONIC TUNNELS
1969 64 p refs
(FFA-MEMO-60-PT-3) Avail: CFSTI

A hypersonic wind tunnel of the heated-air, semi-open jet, blowdown type is described. The air supply for the tunnel consists of a compressor, a drier, and a high pressure vacuum chamber. This facility also contains a hypersonic tunnel of the blowdown to atmosphere type with axisymmetric nozzles and an open jet test section, and a hypersonic gun tunnel which has been converted into a by-pass piston tube. This tube can be used either as a high performance shock tube driver or as a high enthalpy hypersonic tunnel. Air supply and data acquisition systems are similar to those of the other facilities. See also abstract N70-10423. R.B.

N70-10816# Defense Documentation Center, Alexandria, Va.
LANDING FIELDS AND RUNWAYS, VOLUME 1 Report Bibliography, Jan. 1953 - Dec. 1968
Jul. 1969 172 p refs
(AD-691000; DDC-TAS-69-49-1) Avail: CFSTI CSCL 1/5

The bibliography is a compilation of reports on landing fields and runways. The reports evaluate and analyze the design configuration, construction, runway materials, coatings, site preparations, surface properties, stability and durability of runways. Author (TAB)

N70-10974*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SHOCK-TUBE FLOW ANALYSIS WITH A DIMENSIONLESS VELOCITY NUMBER
N. Muniswamy Reddy Washington Nov. 1969 18 p refs
(NASA-TN-D-5518; A-3208) Avail: CFSTI CSCL 14B

The classical shock tube equation, for a constant area shock tube, is rederived in terms of a dimensionless velocity. The equation reduces to a universal form so that a single graphical plot gives the solution of the shock tube equation for all combinations of pressures and temperatures in the driver. Real gas effects behind the shock wave are included in the solution, but the driver gas is assumed to be perfect with a constant ratio of specific heats. Specific solutions for perfect and real driven gases are discussed. All the thermodynamic quantities behind the unsteady rarefaction wave, ratios across the contact surface, wave diagram parameters and testing time in a shock tube are expressed in terms of the dimensionless velocity. Twin tailoring constants are obtained from the universal shock tube equation, one giving the tailoring Mach number and the other giving the loading pressure ratio and speed of sound ratio required to achieve the tailoring Mach number. Conditions for matching the thermodynamic quantities across the contact surface are given, in terms of the dimensionless velocity, and their significance in shock tube performance is discussed. Author

N70-11004# Tri-State Transportation Commission, New York.
IMPROVING ACCESS TO NEWARK AIRPORT
Feb. 1969 23 p Sponsored by Bureau of Public Roads
(PB-182903; Rept-3020-6916-3C) Avail: CFSTI CSCL 13B

Because of its location in the center of a vast and elaborate transportation network in the meadowlands near the heart of the Tri-State Region, Newark Airport is near many rail lines and connects to many highway routes. The report considers an array of combinations that would connect downtown Newark to the new airport terminal by much improved rail and bus service. Of these, eight are selected as the most reasonable alternatives for deeper study. These eight alternatives are described. Author (USGRDR)

N70-11043# Peat, Marwick, Livingston and Co., Boston, Mass.
REPORTS ON PRELIMINARY PLAN FOR AIRPORTS IN THE CAPITOL REGION
May 1969 15 p refs Sponsored by Dept. of Housing and Urban Develop. and Conn. Aeron. Commission
(PB-185536) Avail: CFSTI CSCL 01E

The document summarizes recommendations that the present runway configuration at Bradley International Airport can handle all projected commercial operations plus related general aviation activity provided a pubicly-owned system of six satellite airfields is developed to accomodate the bulk of new general aviation grown in Connecticut's Capitol Region. Author (USGRDR)

N70-11062# Speas (R. Dixon) Associates, Inc., Atlanta, Ga.
REGIONAL AIR FACILITIES STUDY AND PLAN: GREENVILLE, PICKENS, AND SPARTANBURG COUNTIES
Walter J. Robinson Jun. 1969 304 p Prepared for Greenville-Pickens Regional Planning Board
(Contract SCP-35)
(PB-185275) Avail: CFSTI CSCL 13B

The report consists of an inventory and analysis of the three county air facilities and the existing system capacity. Using data generated by previous studies or obtained through inventory and passenger origin and destination survey, a forecast of air facilities requirements through 1990 was derived. A plan was developed to enumerate actions necessary to increase the capacity of the air facilities. The plan recognizes and perpetuates the system concept of airport development. Author (USGRDR)

N70-11255# European Space Research and Technology Center, Noordwijk (Netherlands).
SIMULATION OF THE MAGNETIC ENVIRONMENT IN THE LABORATORY
O. G. Feil
Environ. and their Role in Spacecraft Technol: Magnetic Aspects May 1969 p 5–21 refs (See N70-11255 01-23)
Avail: CFSTI

Typical magnetic test purposes and requirements are listed and the need for a controlled magnetic field environment discussed. Following a brief description of the earth's field on the ground, methods for simulating magnetic space environments are outlined, as well as the requirements for a magnetic test laboratory. Finally, the ESTEC magnetic test laboratory is briefly described. Author (ESRO)

N70-11289*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXPERIMENTAL INVESTIGATION OF THE VELOCITY FLUCTUATIONS BEHIND OSCILLATING VANES
Donald A. Buell Washington Nov. 1969 54 p refs
(NASA-TN-D-5543) Avail: CFSTI CSCL 20D

Vortices were generated in a low-speed airstream by arrays of constant-chord vanes oscillating with amplitudes up to 16 deg. The resulting gusts at the center of the channel downstream from the vanes were predominantly lateral or longitudinal depending upon the phase and arrangement of the vanes. The maximum gust amplitudes near the centerline of the channel were over 45 percent of the free-stream velocity in both directions. The lateral extent of the gusts, especially the longitudinal gusts, was limited, and vane configurations that would improve the lateral distribution were investigated. Selected components of the fluctuations were analyzed for spectral content. Author

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N70-10033 Stanford Univ., Calif.
FLOW WITH COUPLED RADIATIVE AND VIBRATIONAL NONEQUILIBRIUM IN A DIATOMIC GAS
Scott Edwin Gilles (Ph.D. Thesis) 1968 219 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-8184

A theoretical model for the interaction of radiative and vibrational rate processes in the flow of an infrared-active diatomic gas is developed, with specific application to radiative acoustics and to flow through a normal shock wave. Macroscopic equations of radiative transfer and vibrational relaxation are obtained that, while retaining the essential features of the microscopic physics, are simple enough to incorporate usefully with the conservation equations of gas dynamics. Dissert. Abstr.

N70-10067# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
SCALE EFFECTS INCLUDING GAS CONTENT UPON CAVITATION IN A FLOWING SYSTEM
Frederick G. Hammit and David M. Ericson, Jr. May 1969 33 p refs
(Grant NSF-GK-1889)
(PB-184594; Rept-01357-11-T) Avail: CFSTI CSCL 20D

The cavitation scale effects relating to gas content, throat velocity, throat diameter, and temperature are examined for a cavitating Venturi using water and mercury as test fluids. The prediction of variation of cavitation number in terms of these variables is discussed. Author (USGRDR)

N70-10108*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y. Aerodynamic Research Dept.
STUDIES OF HYPERSONIC VISCOUS FLOWS OVER A BLUNT BODY AT LOW REYNOLDS NUMBER

Sang-Wook Kang Sep. 1968 46 p refs
(Contract NAS5-9978)
(NASA-CR-106560; CAL-AI-2187-A-9) Avail: CFSTI CSCL 20D

The effects of mass injection on the viscous hypersonic shock layer in the forebody region (downstream as well as the stagnation point) of a blunt body are theoretically analyzed for a nonreacting gas in the incipient merged layer regime. Both the normal and the streamwise components of the Navier–Stokes equations, along with the energy equation, are considered under the thin shock layer assumption. After a suitable coordinate transformation, nonsimilar solutions are obtained by application of an integral method for blowing rates ranging from zero to as large as the free stream mass flux. Significant influences of blowing on the character of the viscous shock layer are observed. Author

N70-10192*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
INTEGRAL-METHOD ANALYSIS FOR A HYPERSONIC VISCOUS SHOCK LAYER WITH MASS INJECTION
Sang-Wook Kang and Michael G. Dunn Apr. 1968 45 p refs
(Contract NAS5-9978)
(NASA-CR-106558; CAL-A1-2187-A-8) Avail: CFSTI CSCL 20D

The hypersonic viscous layer at low Reynolds numbers with blowing was analyzed in the stagnation region of a blunt body. By application of an integral method to the streamwise momentum, the normal momentum, and the energy equations, results are obtained for various values of the blowing rate and for various degrees of rarefaction of the flow. Significant effects of blowing on the character of the flow are observed. Author

N70-10284# Michigan Univ., Ann Arbor. Lab. of Cavitation and Multiphase Flow.
CAVITATING FLOW PAST TRANSVERSE CYLINDER IN VENTURI DIFFUSER WITH WATER AND MERCURY
Frederick G. Hammitt and Dale J. Kemppainen Mar. 1969 21 p refs Presented at the 3rd Conf. on Hydraulics and Machinery, Budapest, Hungary, 22–27 Sep. 1969
(Grant NSF GK-1889)
(PB-184294; Rept-01357-6-T) Avail: CFSTI CSCL 20D

A new cavitation test geometry, using a cylindrical pin positioned across the conical diffuser portion of a cavitating venturi, was described along with preliminary test results. The characteristics of damage rates achieved using room temperature mercury as test fluid and 304 stainless steel as the damage specimen are reported. It is found that the venturi pressure drop required for maximum damage rate scales approximately with the throat velocity squared and that the damage rate increases from the beginning of the test to a relatively constant value during the period of approximately 2–6 hours duration. Author (USGRDR)

N70-10285# California Univ., Livermore. Lawrence Radiation Lab.
RESULTS AND PERSPECTIVES OF INVESTIGATIONS ON THE MODIFIED STATE OF LIQUIDS AND THEIR BOUNDARY LAYERS
B. V. Deryagin Oct. 1968 24 p refs Transl. into ENGLISH from Vsesoiuznoe Khimicheskoe Obshchestvo im D. I. Mendeleeva (Moscow), v. 12, 1967 p 521–526
(PB-184299T; UCRL-Trans-10282) Avail: CFSTI CSCL 07D

Considered are the development of structural representations and the related theoretical concepts as applied to water. USGRDR

N70-10288 Tennessee Univ., Knoxville.
AN INVESTIGATION OF NOISE IN PROPORTIONAL FLUID AMPLIFIERS
Robert Gene Daniel (Ph.D. Thesis) 1968 198 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-7146

The application of proportional fluid amplifiers to control systems has been very slow since their initial development in 1960. The amplifiers' high noise-to-signal ratio has greatly influenced their limited use. This thesis investigates the sources of this noise which actually appears as turbulence. Noise is considered from the theoretical and experimental aspect. A comprehensive review of the literature is used to bring together previous noise studies which have an application to fluid amplifiers. A different approach to the determination of the flow gain is presented and verified experimentally. An application of photoviscosity to experimental investigation of flow fields in fluid amplifiers is given and qualitative experimental results are used to locate the centers of turbulence within the amplifier. Equivalent electrical circuit models for fluid amplifiers are considered. The experimental frequency response is obtained from the transient response of fluid devices by means of Samulon's spectrum analysis utilizing a digital computer. Dissert. Abstr.

N70-10347# Sandia Corp., Albuquerque, N. Mex.
STRONGLY IONIZING HIGH EXPLOSIVE SHOCKS
M. Cowan and D. A. Freiwald 1968 17 p refs Sponsored by AEC
(PB-184639; SC-DC-69-1871) Avail: CFSTI CSCL 14B

This report describes a technique which utilizes high explosive for generating ionizing shock waves and high speed flow. Previously reported techniques differ in important ways from the one described here. The technique compresses the driven gas directly with the gaseous products of the high explosive detonation. The explosive has a geometry which produces high velocity detonation products (18 km/sec) which carry more than half of the detonation energy. Combining this shaped explosive with converging geometry and double chamber operation, high velocity shock wave are established in relatively large diameter tubes more suitable for experimental use of the high-temperature, high-speed flow. Author (USGRDR)

N70-10376# Avco-Everett Research Lab., Everett, Mass.
A THEORETICAL INVESTIGATION OF THE HYPERSONIC AXISYMMETRIC NEAR WAKE RECOMPRESSION REGION
Michael L. Finson and Robert F. Weiss Jul. 1969 67 p refs Sponsored jointly with SAMSO
(Contract F04701-69-C-0122; ARPA Order 1092)
(AD-692110; AERL-RR-334; SAMSO TR-69-175) Avail: CFSTI CSCL 16/3

The pressure distribution in the laminar, hypersonic, axisymmetric near wake of slender bodies is investigated. Implosion of the inner streamlines of the inviscid, rotational wake of the boundary layer produces a local maximum in the axial pressure distribution. Characteristics/stream tube calculations are presented which reproduce the observed axial pressure distributions, including the effect of variable Reynolds number. A scaling law is obtained which shows that the magnitude of the pressure maximum increases with decreasing Reynolds number; the hypersonic interaction parameter is central to this correlation of experimental data. The effects of variable cone angle and free-stream Mach number upon the calculated pressure distributions are easily accounted for. A critical point is shown to exist in the region of favorable pressure gradient, and a near wake uniqueness criterion is thereby deduced. Author (TAB)

N70-10379 Missouri Univ., Columbia.
AN ADAPTATION OF BOUNDARY-LAYER THEORY TO THE CALCULATION OF WIND-INDUCED STRESSES IN CYLINDRICAL SHELL STRUCTURES
Keith Harlin Denson (Ph.D. Thesis) 1968 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-3227

Pressure distributions were obtained by assuming potential flow up to the boundary layer separation point and a constant wake pressure. Potential flow pressure distributions were obtained by evaluating surface velocities and pressures on a circular ogive from a complex transformation. The separation point of the boundary

layer was calculated. Wake pressure was estimated by subtracting form-drag forward of the separation point from total drag obtained by the use of drag coefficients. The remainder of the drag was assumed to be caused by a constant wake pressure. Calculated pressure distribution on a full circular cylinder was in good agreement with the experimental measurements. Wind load on cylindrical shell structures was also represented by a sine function and by a stepwise approximation. Shell displacements and stress resultants caused by these loadings were compared with those caused by the Potential Flow/Separation pressure distribution. Highly significant differences in both displacements and stress resultants were found on the example shell. Dissert. Abstr.

N70-10381 Lehigh Univ., Bethlehem, Pa.
AN EXPERIMENTAL INVESTIGATION OF PRIMARY AND SECONDARY VELOCITY FOR TURBULENT FLOW IN ECCENTRIC ANNULI
Paul Vinson Tebo (Ph.D. Thesis) 1968 297 p
Avail: Univ. Microfilms: HC $13.50/Microfilm $3.85 Order No. 69-7364

The results of a experimental study of the turbulent flow of air in eccentric annuli, with particular emphasis on an examination for secondary flow, is reported. Preliminary open pipe and concentric pipe tests indicated that attainment of a linear axial pressure gradient is insufficient to prove establishment of fully developed turbulent flow. Primary velocity measurements, using an impact pressure probe, of the eccentric annular flow field indicated that the shape of the isovel structure suggest the presence of secondary flow. The transition from a developing to a fully developed turbulent flow field, between test positions of 86 and 145 hydraulic diameters from the entrance region, eliminated the majority of the unusual isovel curvatures observed. Examination of the flow fields for both developing and fully developed turbulent flow, was made for the presence of secondary flow at positions of unusual isovel curvature and positions near the corner. The corner region is formed by the convergence of the core and shell walls and point of contact, and represents a possible area of secondary flow production. Dissert. Abstr.

N70-10427*# University of Southern Calif., Los Angeles.
THOUGHTS ON COMPRESSIBLE TURBULENT BOUNDARY LAYERS
John Laufer *In* NASA, Washington Compressible Turbulent Boundary Layers 1969 p 1–13 refs (See N70-10426 01-01)
Avail: CFSTI CSCL 20D

A qualitative discussion of compressibility effects on turbulence is given. On the basis of this, a critical examination of the calculation techniques and transformation methods used for the prediction of mean velocity and temperature distributions is made. Author

N70-10428*# IIT Research Inst., Chicago, Ill.
CALCULATION OF INCOMPRESSIBLE TURBULENT BOUNDARY LAYERS: A REVIEW OF THE AFOSRIFP-STANFORD 1968 CONFERENCE
M. V. Morkovin and S. J. Kline *In* NASA, Washington Compressible Turbulent Boundary Layers 1969 p 15–26 refs Prepared in cooperation with Stanford Univ. (See N70-10426 01-01)
Avail: CFSTI CSCL 20D

The primary objective of the conference reviewed was calibration of the numerous procedures for analyzing turbulent boundary layers. Summaries of the state of knowledge regarding separation, the structure of turbulence, and other related "physics" and research needs were also undertaken. Conference preparation included selection and standardization of a set of base data for comparison with theory. Ultimately, prediction of at least R sub theta, H, and C_f for the mandatory flows were completed for 30 prediction methods, and these data are compiled in a form for ready comparison in the proceedings. An evaluation committee provided a rough order of merit of reliability with which various methods predict the mandatory flows, and used this information to examine the utility and promise of various physical assumptions and mathematical frameworks. Author

N70-10429*# Princeton Univ., N.J.
A METHOD OF CALCULATING COMPRESSIBLE TURBULENT BOUNDARY LAYERS
H. James Herring and George L. Mellor *In* NASA, Washington Compressible Turbulent Boundary Layers 1969 p 27–132 refs (See N70-10426 01-01)
(NASA-CR-1144) Avail: CFSTI CSCL 20D

The essential unknown quantity in a compressible turbulent boundary layer is shown to be the kinematic Reynolds stress, as in incompressible flow, and does not explicitly involve density fluctuations. Based on this, the incompressible turbulent viscosity proposed by Mellor is extended to include compressible flows. The same values of the three empirical constants, which were obtained solely from constant-property, constant-pressure experiments, are also used. Without making any further assumptions beyond those related to the usual time averaged boundary layer equations, this system of equations has been programmed for numerical solution. Solutions have been compared to a considerable amount of constant-pressure data in the range from subsonic flows to flows with Mach numbers around 5.0 and the comparisons are quite favorable. Heat transfer data in incompressible flows with variable pressure gradients have been checked against calculations and the comparisons are generally favorable. Author

N70-10430*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF SOME SIMPLIFIED MODELS OF TURBULENCE
Robert G. Deissler *In its* Compressible Turbulent Boundary Layers 1969 p 133–148 refs (See N70-10426 01-01)
Avail: CFSTI CSCL 20D

The derivation of multipoint correlation and spectral equations for turbulent flow is reviewed, and the physical significance of the various terms in the equations is discussed. Because of the nonlinearity of the Navier–Stokes equations the system of correlation or spectral equations is indeterminate. In order to obtain a solution which illustrates some of the turbulent processes, the system of equations is closed by assuming that the turbulence is moderately weak. The solution assumes homogeneous turbulence with no mean velocity gradients and includes the transfer of turbulent energy between eddy sizes and the dissipation of energy. To illustrate the production of turbulent energy from a mean flow field, the analysis is extended to include a uniform mean velocity gradient. Although the energy transfer between wave numbers due to triple correlations is neglected in this case, an energy transfer associated with the mean velocity gradient occurs. The analysis is carried out for an incompressible fluid, but it can be shown that the same equations apply when mean property gradients are present, provided the gradients are not too large. Author

N70-10431*# General Applied Science Labs., Inc., Westbury, N.Y.
ON THE APPLICABILITY OF TRANSFORMATION THEORY TO VARIABLE PROPERTY TURBULENT BOUNDARY LAYERS WITH PRESSURE GRADIENT AND HEAT AND MASS TRANSFER
Constantino Economos *In* NASA, Washington Compressible Turbulent Boundary Layers 1969 p 149–180 refs (See N70-10426 01-01)
(Contract NAS1-8424)
Avail: CFSTI CSCL 20D

Various properties of the Coles' compressibility transformation when modified and extended to include turbulent boundary layer flows with mass transfer and pressure gradient are examined. First the formulation for the mass transfer case in the absence of

pressure gradient is developed and its applicability demonstrated by comparison with experimental data involving both homogeneous and heterogeneous injection as well as chemical reaction. This modified form of the transformation is then applied to the impermeable case and is shown to differ significantly from the earlier Baronti – Libby formulation. In particular, improved agreement with experimental skin friction data obtained under cold wall conditions is demonstrated. The implications of this result with regard to the more general case involving simultaneous mass transfer and pressure gradient are then discussed. In addition to these considerations the inability of the transformation to preserve the "wake component" of the velocity distribution is examined.
Author

N70-10432*# United Aircraft Corp., East Hartford, Conn. Research Labs.
AN ASSESSMENT OF CERTAIN PROCEDURES FOR COMPUTING THE COMPRESSIBLE TURBULENT BOUNDARY LAYER DEVELOPMENT
Henry Mc Donald *In* NASA, Washington Compressible Turbulent Boundary Layers 1969 p 181 – 229 refs (See N70-10426 01-01)
Avail: CFSTI CSCL 20D

A brief review of the state-of-the-art of predicting the compressible turbulent boundary layer development is presented together with an extensive comparison between the predictions of four selected procedures and the available measurements. Three of the procedures considered are integral methods of computing the boundary layer development and utilize a compressibility transformation to reduce the problem to the more manageable one of predicting the development of an equivalent incompressible turbulent boundary layer. One of the integral procedures takes into account the effect of upstream history on the turbulent shear stress. The fourth procedure considered is a numerical solution to the boundary layer partial differential equations of motion and in this case the turbulent shear stress is described by a simple eddy viscosity model. The results of the comparison between theory and experiment indicate that, relative to incompressible flow, much poorer agreement is obtained when the pressure gradients are pronounced. The cause of the large discrepancies is tentatively attributed to the neglect of the static pressure variation normal to the wall. No significant gain in accuracy of prediction in the present case was found to result from the use of the numerical solution of the boundary layer partial differential equations of motion compared to the less rigorous, but much faster, integral procedures.
Author

N70-10433*# Aeronautical Research Associates of Princeton, Inc., N.J.
CALCULATION OF TURBULENT SHEAR FLOWS THROUGH CLOSURE OF THE REYNOLDS EQUATIONS BY INVARIANT MODELING
Coleman duP. Donaldson and Harold Rosenbaum *In* NASA, Washington Compressible Turbulent Boundary Layers 1969 p 231 – 253 refs (See N70-10426 01-01)
Avail: CFSTI CSCL 20D

This paper presents a progress report on work concerned with the development of a method for computing the characteristics of turbulent shear layers which will not suffer from some of the restrictive assumptions of present methods and which, hopefully, will be applicable to a number of interesting turbulent shearing problems other than the conventional turbulent boundary layer. The method has come to be called the method of invariant modeling since the technique is based on a closure of the equation for the Reynolds stress tensor by means of physical models of the higher order terms in this equation that are invariant under transformation of coordinate systems.
Author

N70-10434*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
HYPERSONIC TURBULENT BOUNDARY-LAYER MEASUREMENTS USING AN ELECTRON BEAM
J. E. Wallace *In* NASA, Washington Compressible Turbulent Boundary Layers 1969 p 255 – 308 refs (See N70-10426 01-01)
(CAL-AN-2112-Y-1) Avail: CFSTI CSCL 20D

An experimental study has been made of hypersonic, turbulent boundary layers developed on a shock-tunnel nozzle wall at cold-wall conditions. The electron beam fluorescence technique was used to obtain distributions of local mean density and also density fluctuations across the boundary layer. In addition to density, simultaneous measurements were made of boundary-layer pitot pressure distributions and of wall heat transfer, skin friction, and static pressure. Since the measured values of static pressure at the wall were found to agree with free-stream static pressures, the measured densities are exactly the inverse of static temperatures in the boundary layer. The resulting profiles of static temperature inferred from the density measurements are far below the values predicted by the classical Crocco integral and its conventional modifications for turbulent flows. Both the density measurements and the accompanying pitot pressure measurements indicate peak fluctuations intensities quite close to the wall and an inflection in the fluctuation intensity in the mid-region of the boundary layer.
Author

N70-10435*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMMENTS ON HYPERSONIC TURBULENT BOUNDARY-LAYER MEASUREMENTS USING AN ELECTRON BEAM
William D. Harvey and Dennis M. Bushnell *In its* Compressible Turbulent Boundary Layers 1969 p 309 – 317 refs (See N70-10426 01-01)
Avail: CFSTI CSCL 20D

Estimates of the root-mean-square velocity fluctuation level and trend at Mach 8.5 were made by utilizing the experimental fluctuating density and pitot pressure measurements of Wallace. Also, fair estimates of both the magnitude and trend of the fluctuating density and velocity can be made by using a mixing length type of approach. Present indications are that for zero pressure gradient the intensity of the fluctuating velocity in a boundary layer may be independent of Mach number.
Author

N70-10456# Naval Ordnance Lab., White Oak, Md.
A GENERALIZATION TO TURBULENT BOUNDARY LAYERS OF MANGLER'S TRANSFORMATION BETWEEN AXISYMMETRIC AND TWO-DIMENSIONAL LAMINAR BOUNDARY LAYERS Final Report
Neal Tetervin 12 Jun. 1969 38 p refs
(AD-692378; NOLTR-69-47) Avail: CFSTI CSCL 20/4

This report presents a derivation of a method for obtaining the properties of a turbulent boundary layer on a body of revolution from the properties on a corresponding two-dimensional body. The method is a generalization to turbulent flow of Manglers well-known transformation for laminar flow; Manglers transformation is a special case of the generalized transformation.
Author (TAB)

N70-10491# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
WAKE RECIRCULATIONS GENERATED BY FLOWS (M GREATER THAN 1) OVER REARWARD FACING STEPS Final Report
Max G. Scherberg Jul. 1969 42 p refs
(AD-692510; ARL-69-0103) Avail: CFSTI CSCL 20/4

A qualitative study is made of the recirculation wake generated by a supersonic flow over a rearward facing step. The setting consists of a primary and secondary core flow of constant density (confirmed by measured small temperature variations) and constant velocity. The core flows are surrounded by shear layers which are boundary layers when adjacent to fixed surfaces and so-called free

layers when they interface with over flows. Pressure and velocity distributions are computed for both the core flows and the shear layers. Special cases are worked out with the aid of experimental data backgrounds. For these special cases, estimates are made of core vorticity and shear layer thicknesses. Author (TAB)

N70-10499# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

RELATIONSHIP BETWEEN A WIENER–HERMITE EXPANSION AND AN ENERGY CASCADE

S. C. Crow and G. H. Canavan (Air Force Systems Command, Kirtland AFB, N. Mex.) Aug. 1969 35 p refs

(DI-82-0897) Avail: CFSTI

Meecham and his co-workers developed a theory of turbulence involving a truncated Wiener–Hermite expansion of the velocity field. The theory reduces to a set of coupled differential equations for deterministic kernels, the randomness being taken up by a white-noise function associated with the initial state of the flow. An analogous set is solved numerically for Burgers' model equation and actual random solutions of the Burgers equation are computed. The theory based on the first two terms of the Wiener–Hermite expansion predicts an insufficient rate of energy decay for Reynolds numbers larger than two, because the equations for the kernels contain no convolution integrals in wave-number space and therefore permit no cascade of energy. An energy cascade in wave-number space corresponds to a cascade up through successive terms of the Wiener–Hermite expansion. Pictures of the Gaussian and non-Gaussian components of an actual solution of the Burgers equation show directly that only higher-order terms in the Wiener–Hermite expansion are capable of representing shocks, which dissipate the energy. Author

N70-10532# Hydronautics, Inc., Laurel, Md.

DRAG REDUCTION IN EXTERNAL FLOWS OF ADDITIVE SOLUTIONS

Jin Wu repr. from Viscous Drag Reduction, 1969 p 331–350 refs

(Contract Nonr-4181(00))

(AD-692035; TR-353-6) Avail: CFSTI CSCL 20/4

A series of measurements of the turbulent drag on a flat plate using homogeneous solutions of high-molecular-weight additives, and a series of visual studies concerning diffusion and entrainment of jets with additive solutions flowing into a turbulent stream of pure water were conducted. A comparison between the ejection study (studies with additive solutions ejected into a pure water boundary layer) data and the results indicates very poor mixing between the ejected fluid and its surroundings. Photographs of submerged jets confirm that additives suppress turbulent diffusion. The flat plate results also suggest that for efficient drag reduction, the solution ejected into the boundary layer should be dilute and that the rate of ejection should be comparable to the discharge within the inner boundary layer (the wall controlled region). These findings suggest that smaller amounts of additive are needed for ejection than are usually estimated, and therefore brighten the hope for the practical application of additives to achieve drag reduction in external flow cases, such as on a ship hull. Author (TAB)

N70-10537# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.

THE SPREAD OF OIL SLICKS ON A CALM SEA

James A. Fay Aug. 1969 15 p refs /its Publ. no. 69-6

Avail: CFSTI

Oil, when spilled on water, tends to spread outward on the water surface in the form of a thin continuous layer. In those instances where this layer is as thin as a wave length of visible light, an iridescent color of the film, caused by light interference, is observed. This tendency to spread is the result of two physical forces: the force of gravity which causes the lighter oil to seek a constant level by spreading horizontally, just as it would on a plane horizontal solid surface, and the surface tension force of pure water, which is usually greater than that of the oil film floating on water. While the oil layer could spread while still remaining intact until it had formed a monomolecular layer, spreading usually stops when the layer is much thicker than this, most likely because of a change in the surface tension properties of the oil. Author

N70-10563 Lehigh Univ., Bethlehem, Pa.

SPREADING AT THE SOLID/OIL/WATER INTERFACE

Joseph Arthur Lavelle (Ph.D. Thesis) 1968 186 p refs

Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-7344

The purpose of this investigation was to develop a theoretical and experimental approach for the measurement of the tendency of an oil to spread and displace water from a solid surface, to determine what types of oil soluble surfactants induce the spreading of oils and the permanent displacement of water, and to elucidate the mechanism by which this phenomenon takes place. A film balance technique was developed for measuring the surface pressures at which oils and oil solutions of surfactants spread and displace water from a solid surface. Experiments were carried out using chrome oxide as a representative high energy solid which was preferentially water wetted. Several polymeric solids were used as representative of low energy surfaces which were preferentially oil wetted. The calculation of various surface chemical properties of low energy solids by use of an arithmetic mean in place of a geometric mean in Fowkes' theory was carried out. Dissert. Abstr.

N70-10582# New York Univ., N.Y. Dept. of Aeronautics and Astronautics.

TURBULENT SLOTINJECTION STUDIES AT MACH 6

K. Parthasarathy and V. Zakkay Apr. 1969 180 p refs

(Contract F33615-68-C-1184)

(AD-692503; NYU-68-39; ARL-69-0066) Avail: CFSTI CSCL 20/4

The use of film cooling for protecting a surface exposed to high temperature air at hypersonic speeds is investigated experimentally. The purpose of the work is to investigate the effects of injecting a coolant on the surface of a hypersonic vehicle in the turbulent boundary layer, and to try to obtain correlation parameters as well as the effective cooling lengths. The tests were conducted in a Mach 6 contoured axisymmetric nozzle with a streamlined centerbody. The Reynolds number in the test section was in the range of 2-3.6 x 10 to the 6th power per inch. Heat transfer distributions were obtained for various injection mass flow rates and the effect of injection on the velocity, temperature and Mach number profiles was studied. Correlations for the adiabatic wall temperatures with injection rates were obtained. Skin friction coefficients were obtained using Baronti-Libby transformations into the incompressible plane. The measured transient heat transfer rates obtained by the thinskin techniques agree with the values predicted by the flat plate reference enthalpy method for the case of no injection. Author (TAB)

N70-10812# Naval Weapons Lab., Dahlgren, Va.

ON THE SURFACE-WAVE PROBLEM FOR SUBMERGED OBJECTS IN STEADY FLOW

John D. Somes Aug. 1969 43 p refs

(AD-692419; NWL-TR-2276) Avail: CFSTI CSCL 13/10

An investigation was made of the surface-wave solutions for a submerged object in steady flow. Empirical results are given which suggest that non-linear effects are significant in two-dimensional flow (as had been indicated by some recent work in the literature), but that these effects are much less significant in three-dimensional potential flow for a bounded object. Hence, a computer program for surface waves, based on the linearized three-dimensional solution, appears adequate for its intended use in

ship wave resistance calculations. A theoretical analysis of the published two-dimensional non-linear solutions gives a satisfactory explanation of their apparently anomalous behavior. However, analytical difficulties still remain in the non-linear theory for submerged objects, and some suggestions for further investigation have been included in this report. Author (TAB)

N70-10640 National Lending Library for Science and Technology, Boston Spa (England).
THE EXPERIMENTAL DETERMINATION OF THE GAS-CONTENT OF TWO-PHASE FLOWS [EKSPERIMENTALNOE OPREDELENINE GAZOSODERZHANIYA DVUKHFAZNYKH POTOKOV]
Yu. I. Azimov et al Jun. 1969 11 p refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii, Khim. i Khim. Tekhnol. (Ivanovo), v. 10, no. 1, 1967 p 107–109
(NLL-RTS-5157) Avail: Natl. Lending Library, Boston Spa, Engl.: 7s 6d

A method for determining the local gas content in a two phase stream of the cellular foam type by measuring the electrical conductivity is proposed. The techniques, and apparatus for the experimental determination of the gas content of a two phase flow system are described. The experimental results are graphed, and it is concluded that the proposed method obtains results of great accuracy in any localized region of the stream. F.O.S.

N70-10649# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.
THE NON-LINEAR REFRACTION OF SHOCK WAVES BY UPSTREAM DISTURBANCES IN STEADY SUPERSONIC FLOW
Sheldon Weinbaum and Arnold Goldburg Sep. 1969 62 p refs
(D1-82-0906) Avail: CFSTI

The propagation of an oblique shock wave through a two-dimensional, steady, nonuniform oncoming flow is studied. A higher order theory is developed to treat the refraction of the incident oblique shock wave by irrotational or rotational disturbances of arbitrary amplitude provided the flow is supersonic behind the shock. A unique feature of the analysis is the formulation of the flow equations on the downstream side of the shock wave. It is shown that the cumulative effect of the downstream wave interactions on the propagation of the shock wave can be accounted for exactly by a single parameter phi, the local ratio of the pressure gradients along the Mach wave characteristic directions at the rear of the shock front. The general shock refraction problem is then reduced to a single nonlinear differential equation for the local shock turning angle theta as a function of upstream conditions and the wave interaction parameter phi. To lowest order in the expansion variable theta phi, this equation is equivalent to Whitham's (1958) approximate characteristic rule for the propagation of shock waves in nonuniform flow. Author

N70-10650# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.
A SIMILARITY LAW FOR THE INFLUENCE OF CHANNEL WALLS VALID FOR ALL VELOCITY REGIMES
J. Zierep Oct. 1969 5 p ref Transl. into ENGLISH from Acta Mech. (West Ger.), v. 6, 1968 p 113–114
(TR-56) Avail: CFSTI

A similarity law, valid for all velocities, for the influence of channel walls is given. Specialization renders the various transformation laws for the coordinates in the direction across the flow. Author

N70-10672# La Plata Univ. (Argentina).
TURBULENT PERTURBATIONS PRODUCED BY POROUS OBSTACLES [PERTURBACIONES TURBULENTAS PRODUCIDAS POR OBSTACULOS POROSOS]
1968 52 p refs In SPANISH /ts Publ. No. 108
Avail: CFSTI

An evaluation of the influence, of a wooded area located near a runway, an atmospheric turbulent perturbations, and its possible relationship to aircraft accidents are studied by introducing a porosity function. An equation is derived for evaluating the turbulent perturbations as a function of wind velocity and direction for the configuration of the airport and the existing obstacles. It is concluded that the turbulence caused by these porus obstacles contribute greatly to the hazards of aircraft runway operations. Transl. by F.O.S.

N70-10675*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. Lab. for Theoretical Studies.
TURBULENCE FROM THE DISTRIBUTION FUNCTION POINT OF VIEW
J. R. Herring Oct. 1969 22 p refs
(NASA-TM-X-63732) Avail: CFSTI CSCL 20D

Two recent approaches to the statistical theory of turbulence based on the distribution function approach, the Generalized random phase approximation and the Self-Consistent Field Approximation are described and compared. These procedures are viewed as alternate ways of expanding the flows probability distribution about its own univariate distribution. The Generalized random phase approximation models the single-mode-turbulence dynamics by a Fokker–Planck equation, while the self-consistent-field procedure uses a similar, but more general formula. Both procedures have as ingredients, the simultaneous time correlation coefficients and eddy relaxation frequencies. Their second order results differ only in the equations determining these eddy relaxation frequencies. The procedures are formully similar to the direct interaction approach. The accuracy of these procedures is assessed by comparing their predictions for the energy spectra of some simple model systems with exact numerical results. Results are also presented for moderate Reynolds number turbulence, and these are compared to similar results for the direct interaction approximation. The failure of these theories to predict a proper Kolmogorov inertial range spectrum is discussed. Author

N70-10681*# General Dynamics/Fort Worth, Tex.
EXPERIMENTAL INVESTIGATION OF THE INTERACTION OF A PLANE, OBLIQUE, INCIDENT-REFLECTING SHOCK WAVE WITH A TURBULENT BOUNDARY LAYER ON A COOLED SURFACE. VOLUME 1: TEST DESCRIPTION AND DATA SUMMARY
Richard F. Kilburg and Donald R. Kotansky Oct. 1969 80 p
(Contract NAS1-6588)
(NASA-CR-66841-1-Vol-1) Avail: CFSTI CSCL 20D

A test was conducted to obtain measurements of the boundary layer total temperature and velocity profiles in the region of the interaction of a two-dimensional, incident, reflecting, oblique shock wave with the turbulent boundary layer on a cryogenically cooled flat plate. Data were taken at Mach numbers of 2.0, 3.2, and 4.2 at unit Reynolds numbers of from 6.4 to 20.2 million per foot. The ratio of wall surface to stagnation temperature was 0.3 for most data. Adiabatic data were taken at a Mach number of 3.2. Incident shock strength was varied by testing with shock generator wedge angles of 6 deg and 8 deg. Data presented include the plate surface pressure distribution, incident and reflected shock locations, and the boundary layer velocity and stagnation temperature profiles. Author

N70-10682*# General Dynamics/Fort Worth, Tex.
EXPERIMENTAL INVESTIGATION OF THE INTERACTION OF A PLANE, OBLIQUE, INCIDENT-REFLECTING SHOCK WAVE WITH A TURBULENT BOUNDARY LAYER ON A COOLED SURFACE. VOLUME 2: BASIC PLOTTED DATA
Richard F. Kilburg Oct. 1969 182 p
(Contract NAS1-6588)
(NASA-CR-66841-2-Vol-2) Avail: CFSTI CSCL 20D

Boundary layer profiles of total temperature, stagnation pressure, static pressure coefficient, and Mach number are presented, with these variables plotted versus distance normal to the surface. The plate surface static pressure (in coefficient form) and temperature (as a ratio to stream stagnation temperature) are shown with respect to distance from the plate leading edge. The data are in groups for each run and are arranged in increasing run order. Author

N70-10683*# General Dynamics/Fort Worth, Tex.
EXPERIMENTAL INVESTIGATION OF THE INTERACTION OF A PLANE, OBLIQUE, INCIDENT-REFLECTING SHOCK WAVE WITH A TURBULENT BOUNDARY LAYER ON A COOLED SURFACE. VOLUME 3: TABULATED DATA
Richard F. Kilburg Oct. 1969 308 p
(Contract NAS1-6588)
(NASA-CR-86841-3-Vol-3) Avail: CFSTI CSCL 20D

The tabulated data are the primary data generated during testing and the nondimensional boundary layer variables based on edge conditions extracted from the primary data. Primary data include (1) the tunnel environmental conditions, (2) the measured or computed data from the boundary layer probe and the probe distance from the plate surface, and (3) the surface pressure and temperature distributions on the plate with respect to the leading edge. The nondimensional boundary layer data include the Mach number, local total temperature, velocity, static pressure, density, and distance normal to the surface. The edge conditions selected from the basic boundary layer data are also listed. Author

N70-10695*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
USE OF PRESTON TUBES FOR MEASURING HYPERSONIC TURBULENT SKIN FRICTION
Earl R. Keener and Edward J. Hopkins Washington Nov. 1969 21 p refs Presented at the AIAA 4th Aerodynamic Testing Conf., Cincinnati, 28 – 30 Apr. 1969
(NASA-TN-D-5544) Avail: CFSTI CSCL 20D

Supersonic Preston tube correlations which account for the effects of Mach number and Reynolds number for adiabatic surfaces are reviewed. Experimental results are presented which show that two of these correlations are applicable to nonadiabatic surfaces in an airstream at a Mach number of 7. Direct measurements with a skin friction balance were used for the calibrations. The Reynolds number ranged from 4 to 110 million, and the ratio of wall to adiabatic wall temperature ranged from 0.3 to 0.5. The major conclusion is that the correlation can be simplified and made independent of the boundary layer edge condition by basing the correlation factors on only three measurements: wall temperature, wall pressure, and Preston tube pressure. Author

N70-10700*# Rice Univ., Houston, Tex.
THE EFFECTS OF UPSTREAM MASS INJECTION ON DOWNSTREAM HEAT TRANSFER
W. Robert Wolfram, Jr. (M.S. Thesis) May 1969 50 p refs
(Grant NGL-44-006-033)
(NASA-CR-106710) Avail: CFSTI CSCL 20D

The effects of upstream mass injection on downstream heat transfer in a laminar nonreacting boundary layer were studied. A numerical technique known as the method of integral-matrix analysis is used. The complete coupled set of nonreacting laminar boundary layer equations with discontinuous mass injection was solved for this problem using the integral-matrix technique. The effects of mass injection on heat transfer to both sharp and blunt-nosed isothermal flat plates were studied for a Mach 2 freestream. The amount of injection and the length of the injected region were varied for each body. Heat transfer rates were found to decrease markedly in the injected region. A sharp rise in heat transfer was found immediately downstream of the region of injection followed by an asymptotic approach to the heat transfer rates calculated for the case of no injection. An insulating effect was found to persist for a considerable distance downstream of the injection region. The distance required for this insulating effect to die out was found to depend on the length of the injection region as well as the rate of injection. Author

N70-10710*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.
A THEORETICAL AND EXPERIMENTAL STUDY OF UNSTEADY FLOW PROCESSES IN A LUDWIEG TUBE WIND TUNNEL
John D. Warmbrod Washington Nov. 1969 23 p refs
(NASA-TN-D-5469; M-151) Avail: CFSTI CSCL 20D

The application of the method of characteristics to calculate the nonsteady discharge of compressed air through a Ludwieg tube type of wind tunnel is presented. The mathematical model that underlies this numerical procedure assumes the flow through the wind tunnel to be time dependent, one dimensional, and compressible. The theoretical results were obtained from a computer program developed for this problem. Diaphragm rupture, variations in cross-sectional areas, contact surfaces, shock waves, and the interaction and reflecting of contact surfaces and shock waves are included in the computer program. The theoretical results are compared with static and total pressures measured in a Ludwieg tube wind tunnel. Good agreement between theory and experiment is achieved for the cases in which the flow in the test section was subsonic. Only fair agreement between the one dimensional theory and experiment was achieved in the supersonic test sections. This difference is believed to be attributed to the two dimensional character of the flow and the extensive flow separation that occurs in the supersonic nozzles during the early development of the flow. Author

N70-10728*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Environmental Sciences Div.
SHOCK-TUBE THERMOCHEMISTRY TABLES FOR HIGH-TEMPERATURE GASES: AIR, VOLUME 1
W. A. Menard and T. E. Horton 1 Nov. 1969 88 p refs
(Contract NAS7-100)
(NASA-CR-106660; JPL-TR-32-1408) Avail: CFSTI CSCL 20D

Thermodynamic properties and species concentrations of equilibrium air are tabulated for moving, standing, and reflected shock waves. Initial pressures range from 0.05 to 50.0 torr, and temperatures from 1000 K to over 100,000 K. In this study, 28 molecular and atomic species are considered. Author

N70-10748# Oklahoma Univ., Norman. Dept. of Meteorology.
HOT-FILM ANEMOMETER MEASUREMENTS OF VELOCITY DECAY IN KARMAN TRAIL VORTEXES Final Report
E. M. Wilkins Oct. 1969 22 p refs
(Grant E-41-67(G))
(ARL-1576-4) Avail: Issuing Activity

The rate of decrease in the magnitude of the maximum tangential velocity of laboratory Karman vortexes is found to be essentially as predicted by means of a two dimensional theory for the diffusion of vorticity. The implication is clear that surface friction effects are not overriding. Certain features of atmospheric Karman vortexes suggest that they are in some important respects dynamically similar to the laboratory vortexes, and thus these vortexes also may experience rather small energy losses from surface friction. Author

N70-10768# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Inst. für Aerodynamik.
ON THE EFFECT OF LOADING, FLOW COEFFICIENT, AND REACTION DEGREE ON THE STALLING CHARACTERISTICS OF AXIAL FLOW COMPRESSOR STAGES [UEBER DEN EINFLUSS VON BELASTUNG,

LIEFERZAHL UND REAKTIONSGRAD AUF DAS ABREISSVERHALTEN VON AXIALVERDICHTERSTUFEN]
Heinz Hoheisel Feb. 1969 47 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-17) Avail: CFSTI

The stalling of a single compressor stage determines the operational range of the axial flow compressor. Therefore, it is particularly interesting to know the effect of the different flow coefficients on the stalling characteristics of an axial flow compressor stage. Starting from experimental results on the working range of two-dimensional cascades, investigations are made on the effect of stage loading, the type of vortex distribution and the reaction efficiency on the stalling characteristics of different kinds of stage design. The effect of Mach number is considered. The theoretical results show that essential improvements of the stalling characteristics can be achieved with a reaction efficiency greater than 0.5. Comparisons of different multi-stage compressors show good agreement between the calculated and experimentally determined surge lines. Author (ESRO)

N70-10811# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Aachen (West Germany). Institut für Theoretische Gasdynamik.
EQUILIBRIUM FLOW OF A GAS CONTAINING SMALL PARTICLES [DIE GLEICHGEWICHTSSTROEMUNG EINES GAS-TEILCHEN-SYSTEMS]
I. Teipel Jun. 1969 22 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-34; DVL-884) Avail: CFSTI

The equilibrium of a heterogenous flow (gas flow containing small particles) is discussed. By simple reduction the new equations can be formally transformed into gas dynamic equations, thus the methods for solving gas dynamic problems can be employed. The following examples have been studied using the new system: one-dimensional unsteady flow, shock waves with and without heat addition and related problems. Author (ESRO)

N70-10827# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Inst. für Angewandte Gasdynamik.
SHAPE FACTORS FOR LARGE SUCTION RATES IN INCOMPRESSIBLE BOUNDARY LAYERS [FORMPARAMETER INKOMPRESSIBLER GRENZSCHICHTEN BEI GROSSEN ABSAUGERATEN]
Egon Krause Jul. 1969 33 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-43; DVL-889) Avail: CFSTI

The variation of displacement thickness, wall shearing stress and shape factors is investigated for discontinuous suction in an incompressible boundary layer. The boundary layer equations are integrated by means of finite difference methods. The suction velocity and the length of the suction region are varied in such a way that the mass removed from the main flow remains constant. Large suction velocities are considered and the results compared with those of other experiments. Author (ESRO)

N70-10852# California Univ., Berkeley. Div. of Aeronautical Sciences.
A NUMERICAL METHOD FOR CALCULATING STEADY UNSYMMETRICAL SUPERSONIC FLOW PAST CONES
D. Etike Ndefo May 1969 88 p refs
(Grant AF-AFOSR-268-68)
(AD-691270; AS-69-11) Avail: CFSTI CSCL 20/4

Telenins numerical method is adapted to the problem of steady supersonic flow past pointed conical bodies at yaw. The method is formulated for cones of circular cross-sections with the intention of determining bounded analytic solutions uniformly valid in the region between the shock and cone surfaces. Attention is focused on the nature of the entropy field and the behavior of the streamlines as influenced by variations in the free-stream conditions. As an example, numerical computations are carried out for flow past a circular cone of semi-apex angle 20 deg yawed at angles of attack varying from 0 to 20 deg with respect to a free-stream of Mach number 3.53. Solutions are compared with experimental results and with solutions based on other numerical methods. The solutions confirm the existence of a vortical singularity at the leeward generator of the cone, but no evidence is found of the lift-off of this singularity as suggested by Ferri. The entropy layer is shown to be very thin at small angles of attack but relatively thick at large angles of attack. The directions from which the streamlines enter the vortical singularity are found to depend on the angle of attack. Author (TAB)

N70-10853# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
INTERNAL WAVES IN A ROTATING FLUID
Giulio Venezian Mar. 1969 25 p refs
(Contract Nonr-220(35))
(AD-691253; Rept-97-16) Avail: CFSTI CSCL 20/4

The problem of inertial waves in a rotating fluid, which is in a close analogy with the internal gravity waves in a stratified fluid, has been further explored. It is shown that transverse waves can exist in a rotating fluid provided their circular frequency is less than twice the angular velocity of the rotating frame. The wave energy is transported at right angles to the phase velocity. In a contained fluid, discrete modes may exist, and resonance is possible. Author (TAB)

N70-10854# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
SPIN-UP OF A CONTAINED FLUID
Giulio Venezian Mar. 1969 27 p refs
(Contract Nonr-220(35))
(AD-691263; Rept-97-17) Avail: CFSTI CSCL 20/4

When a container filled with fluid rotates uniformly, the fluid ultimately reaches a state of rigid body rotation with the same angular velocity as the container. The process whereby the fluid changes its angular velocity from an initial value to a final one when the walls of the container are given a corresponding change is called spin-up (or spin-down if the final angular speed is less than the initial one). In a more general sense, the spin-up process is involved in the approach to steady state of all contained fluid motions in which the final state is dominated by rotation. In all spin-up phenomena, the steady state is reached not by viscous diffusion but by an internal circulation produced by the Ekman layer suction. We have shown previously that the time constant associated with the decay of motion in a contained fluid is proportional to squared root of E, where E is the Ekman number. The characteristic time for viscous diffusion, on the other hand, is proportional to E and since in most applications E is very small, a time scale of order square root of E is much shorter than one of order E. Spin-up is therefore the more effective of two mechanisms. Author (TAB)

N70-10894 National Lending Library for Science and Technology, Boston Spa (England).
EQUATIONS OF MOTION OF TWO-PHASE MEDIA [URAVNENIYA DVIZHENIYA DVUKHFAZNYKH SRED]
M. E. Deich et al Jun. 1969 13 p refs Transl. into ENGLISH from Prace Inst. Maszyn Przeplywowych (Poland), no. 29–31, 1966 p 349–356
(NLL-RTS-5204) Avail: Natl. Lending Library, Boston Spa, Engl.: 22s 6d

The flow of inhomogeneous media is investigated by deriving the equations of motion with respect to intuitively determined quantities through a probability method of transformation. The probability that the assigned number for each point of the space occupied by the medium contains a given phase is reduced to physically observable quantities. Determination of the phase distribution probabilities and their connection with measures of

corresponding sets makes it possible to determine the density of the medium and its phases. The laws of conservation of mass, momentum, and total energy are then employed to derive the equations characterizing the motion of phase and medium. Example calculation for one dimensional flow in channels of variable cross sections are given. G.G.

N70-10968# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF THE VIBRATIONAL RELAXATION OF MOLECULES ON DISSOCIATING AIR CHARACTERISTICS BEHIND A STRONG SHOCK FRONT
S. A. Losev et al 1969 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 4, 1969 p 84–90
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Chemical reaction mechanisms in hot air are studied to explain the conditions behind a strong shock front. A connection is established between the rate of the chemical process and the vibrational state of the molecules by using the diffusion approximation in the theory of chemical reactions. The activation of the molecules is considered to be connected only with vibrational excitation, and it is assumed that the molecules can be approximated by a harmonic oscillator model. Direct numerical solution of oxygen plus argon collisions demonstrated the applicability of the diffusion reaction to dissociation reactions. The Fokker–Planck equation was applied and further mathematical analyses demonstrated the relations which connect the chemical reaction rate with the vibrational state of the molecule. Correspondence between the general analytical solutions obtained and experimental results in other investigations were in satisfactory agreement only when the influence of delay in excitation of the molecular vibrations on the chemical reactions was considered. M.H.E.

N70-10975*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A METHOD FOR SOLVING THE NONSIMILAR LAMINAR BOUNDARY-LAYER EQUATIONS INCLUDING FOREIGN GAS INJECTION
Joseph G. Marvin and Yvonne S. Sheaffer Washington Nov. 1969 30 p refs
(NASA-TN-D-5516; A-3354) Avail: CFSTI CSCL 20D

A numerical method for solving the nonsimilar boundary layer equations, including binary gas injection, is developed for nonreacting gases. The continuity, momentum, energy, and species–concentration equations and boundary conditions are reduced to a set of linear algebraic equations in terms of the dependent variables only by appropriate application of implicit finite difference expressions. To solve the equations, profiles of the unknowns at the initial station are specified, together with certain boundary conditions along the body surface and boundary layer edge. The initial profiles are obtained through solution, by the same method, employing the similarity form of the conservation equations that apply exactly at the starting points for the problems considered. Comparisons of the present solutions with exact similarity solutions for air and helium injection are presented to demonstrate the accuracy of the method for evaluating the dependent variables along the initial data line. Comparisons of the present solutions with nonsimilar solutions obtained from other numerical methods and comparisons with experimental data for air, argon, and helium injection are presented to evaluate the accuracy and advantages of the method. Author

N70-11036# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LAMINAR MOTION OF MULTIPHASE MEDIA IN PIPES
D. F. Fayzullayev 20 Mar. 1969 188 p refs Transl. into ENGLISH of the book 'Laminarnoye Dvizheniye Mnogofaznykh Sred V Truboprovodakh' Tashkent, 1966 p 1–220
(AD-690397; FTD-HT-23-889-68) Avail: CFSTI CSCL 20/4

The monograph presents a correlation of studies concerning laminar flow of compressible and incompressible, viscous, ideal and viscoideal, steady and unsteady, mutually-soluble, multiphase media in pipes. In addition to theoretical studies, the results of experimental investigations which confirm some of the theoretical conclusions are also given. Author (TAB)

N70-11052# Lockheed Missiles and Space Co., Palo Alto, Calif.
BOUNDARY LAYER SEPARATION ON CONICAL BODIES
E. N. Bondarev 1969 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 4, 1969 p 46–52
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Some peculiarities in the change of the linear dimensions of the separation flow zones on conical bodies with expanding conical flares and the pressures within these zones are investigated as a function of the change in Mach and Reynolds numbers and of the intensity of the perturbation causing boundary layer separation. Results are given for laminar, transitional, and turbulent flow conditions in the separation stream domains. Author

N70-11077# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
GENERAL VARIATIONAL ANALYSIS OF HYDRODYNAMIC, THERMAL AND DIFFUSIONAL BOUNDARY LAYERS
Daniel Weihs and Benjamin Gal-or Jul. 1969 35 p refs
(TAE-98) Avail: CFSTI

A general variational formulation of fluid flow in the boundary layer, including viscous effects, coupled heat, and multicomponent mass transfer and chemical reactions, is presented. The resulting functional, which is based on the local potential concept, is separated by use of the so-called Curie principle, into two parts representing the transfer of momentum, and the combined transfer of heat and mass. Approximate analytical solutions for the velocity, enthalpy, and species concentrations fields for steady state boundary conditions can be derived from the two resulting functionals. Some examples, including isothermal incompressible flow on a flat plate, and multicomponent flow with diffusion for arbitrary Schmidt numbers are solved, and the results are shown to be in excellent agreement with known or numerical solutions for simple approximating functions. Author

N70-11084# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
ON STAGNATION-POINT CONDITIONS IN NONEQUILIBRIUM INVISCID BLUNT-BODY FLOWS
Marcel Vinokur Oct. 1969 56 p refs
(LMSC-6-78-69-36) Avail: CFSTI

Basic equations are formulated and previous analyses relating to the stagnation point state are critically reviewed. A method for simply predicting the variation of this state with the nonequilibrium process is developed. both plane and axisymmetric flows are simultaneously treated, including the effect of a nonequilibrium free-stream. A.C.R.

N70-11087 National Lending Library for Science and Technology, Boston Spa (England).
THE SUPPORT EFFECT IN THE MEASUREMENT OF FLOW IN A PIPE USING SEVERAL CURRENT METERS
M. Tonini 29 Apr. 1969 11 p refs Transl. into ENGLISH from Energia Elettrica, v. 43, no. 4, Apr. 1968 p 215–220
(NLL-CE-Trans-5076-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Research into the support effect, a phenomena causing current meters to register a velocity higher than the actual one, was conducted in an open-conduit penstock. Four tests were

carried out at different times, with each test including measurements using two types of equipment. The number of arms was changed from an eight-arm framework to a four-arm framework by withdrawing the ring from the penstock and leaving the flow conditions unaltered. The objective was to determine the difference in flow between these two measuring configurations, taking into consideration effective error. Plotting of final values obtained on a graph with Cartesian axes indicated an absolute error of +0.35% and +.65% for the four-arm and eight-arm arrangements respectively. The eight-armed framework, of greater dimensions, exhibits flows greater than those obtained with the four-armed framework. These results must be viewed as only preliminary in nature; they indicate that the support effect is principally a function of the dimensions of the meter-bearing structure, although other factors must also be considered. In addition, it appears that if the dimensions of the measured equipment are kept within normal limits, the resultant error falls within acceptable tolerance levels. A.C.R.

N70-11104*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BOUNDARY-LAYER VELOCITY PROFILES DOWNSTREAM OF THREE-DIMENSIONAL TRANSITION TRIPS ON A FLAT PLATE AT MACH 3 AND 4
John B. Peterson, Jr. Washington Nov. 1969 88 p refs
(NASA-TN-D-5523; L-6486) Avail: CFSTI CSCL 20D

Boundary layer profiles were measured downstream of three different configurations of carborundum type transition trips to determine whether the trips caused distortions of the boundary layer. The measured boundary layer profiles showed that the distortions were very small even for trips larger than the laminar boundary layer height at the trip location. Author

N70-11170# Naval Postgraduate School, Monterey, Calif.
NONSIMILAR SOLUTION OF THE LAMINAR BOUNDARY LAYER IN AN OSCILLATORY FLOW BY AN INTEGRAL MATRIX METHOD
Barry Allen Gastrock (M.S. Thesis) Jun. 1969 100 p refs
(AD-692444) Avail: CFSTI CSCL 20/4

The development of a numerical procedure for the treatment of nonsimilar, unsteady, laminar boundary layers is presented. The solution is obtained from the laminar, isothermal, incompressible boundary layer equations employing a modification of the integral matrix procedure of Bartlett and Kendall. Solutions of example problems are presented for steady Blasius and Howarth flows, and for oscillating Blasius flow. Agreement with the known classical results is satisfactory and establishes the general feasibility of the method. Core storage requirements of 130,000 bytes allow consideration of as many as 25 nodal points across the boundary layer, 50 time increments per oscillation cycle and 50 streamwise stations. Author (TAB)

N70-11186# Purdue Univ., Lafayette, Ind. Fluid Mechanics Group.
AN INTEGRAL-DIFFERENTIAL-DIFFERENCE METHOD ANALYSIS OF VISCOUS FLOW OVER AN IMPULSIVELY ACCELERATED SEMI-INFINITE PLATE
Stephen J. Koob and Douglas E. Abbott Dec. 1968 176 p refs
(Contract DA-31-124-ARO-D-479)
(AD-691894; FMTR-68-2; AROD-6340-4-E) Avail: CFSTI CSCL 20/4

The suddenly accelerated semi-infinite flat plate problem is analyzed by an integral-differential-difference method. The solutions obtained using boundary-layer equations and modified boundary-layer or Navier-Stokes type equations are strikingly different. Author (TAB)

N70-11231# California Univ., Livermore. Lawrence Radiation Lab.
FINITE DIFFERENCE SCHEME FOR CALCULATING PROBLEMS IN TWO SPACE DIMENSIONS AND TIME
Mark L. Wilkins 4 Aug. 1969 16 p ref Presented at the 2nd Intern. Colloq. on Gas Dyn. of Explosions and Reactive Systems, Novosibirsk, USSR, 24–29 Aug. 1969 Sponsored by AEC
(PB-185545; UCRL-71724) Avail: CFSTI CSCL 20D

An artificial viscosity method for calculating problems in hydrodynamics is described for one dimensional flow with the Lagrange form of hydrodynamic differential equations. The region of flow is divided into a finite mesh of grid points at which the various parameters can be specified. The differential equations are then approximated by a second order difference scheme using the minimum number of grid points. The grid is then stabilized by adding an artificial viscosity to the equations of motions. In this manner the operation of the artificial viscosity is known, and its magnitude can be compared with the magnitude of physical stresses in the problem. The paper demonstrates the effectiveness of the program for solving a range of physical problems. Examples are given in elasticity, elastic-plastic flow, seismology and gas dynamics. Author (USGRDR)

N70-11353# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON A THEORY OF LAMINAR BOUNDARY LAYER SEPARATION IN A SUPERSONIC STREAM
V. Ia. Neiland 1969 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 4, 1969 p 53–57
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

An attempt is made to construct a method of computation on the basis of an analysis of the asymptotic behavior of the solutions of the Navier–Stokes equations as the Reynolds number tends to infinity, and of the application of the known principle of splicing asymptotic expansions which represent the solution in different flow regions. Equations and boundary conditions for a first approximation, the method and results of a numerical integration for a domain above and including the point of separation are described. A comparison is made with experimental results, as well as with estimates of the corrections corresponding to the second approximation. On the basis of the results obtained, the question of the limits of applicability of approximate theories utilizing the boundary layer equations is discussed. Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N70-10073 North Carolina State Univ., Raleigh.
DEVELOPMENT AND EVALUATION OF A PROCEDURE FOR USING AERIAL PHOTOGRAPHS TO CONDUCT A SURVEY OF COASTAL EROSION
Donald Bennett Stafford (Ph.D. Thesis) 1968 230 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 69-7666

The use of the procedure is illustrated by data from Onslow and Carteret Counties in North Carolina and a preliminary evaluation of the results obtained in these two counties is given. The procedure consists of selecting stable reference points on aerial photographs taken in different years and making measurements on the aerial photographs between the stable reference points and points on the transient beach. The change in two locations on the beach, the dune line and the high water line, is determined. Attempts to determine changes in a third location, the water line, were abandoned. The most important types of errors in aerial photographs are discussed in detail and techniques for minimizing the errors are proposed. Data indicate that erosion is the predominant process

that has occurred and that considerable variation exists in the rate of change between different sections of beach and different time intervals. A preliminary evaluation of the composite error present in the measurement techniques and aerial photographs is given for the different types and scales of aerial photographs used. Dissert. Abstr.

N70-10130# Joint Publications Research Service Washington, D.C.

OCEANOGRAPHY

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 209 31 Jul. 1969 p 7-10 refs (See N70-10127 01-34)
Avail: CFSTI

Simultaneous registration of water temperature and submergence depth was obtained using a shipboard EPP-09 potentiometer connected to sensors by a multistrand cable. This method for broadening the potentiometer measurement limit is suitable only in cases when a signal is fed from the diagonal of an unbalanced bridge, but it can be used extensively in other types of measurements with an error limit of + or - 0.25%. Experimental data on small-scale marine turbulence data is reviewed. Discovery of an uncharted guyot, a flat-topped underwater mountain, during the 43rd voyage of the research vessel Vityaz is also reported. Measurement of physical fields in the ocean in a special polygon over a continuous two-month period is briefly described, and potential factors that modify the Arctic Basic climate are identified. A.C.R.

N70-10131# Joint Publications Research Service, Washington, D.C.

TERRESTRIAL GEOPHYSICS

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 209 31 Jul. 1969 p 11-24 refs (See N70-10127 01-34)
Avail: CFSTI

A differential formula is presented that is being used with proton magnetometers incorporating a ring system in absolute observations of the H-component, and the accuracy of measured and computed elements of the Soviet astronomical-geodetic network is reported. Modern aerial methods are classified in four types: photographic, geophysical, visual, and scanning-based systems. Mention is also made of the use of Monte Carlo algorithms for neutron gamma logging. The present status of marine drilling in the USSR, the validity of paleomagnetic data in explaining continental drift phenomena, and a portable quartz inclinometer for highly precise leveling of various instruments are briefly treated. Short summaries are included for various investigations of the earth's crust, atmospheric geomagnetism, and seismic activity. A.C.R.

N70-10132# Joint Publications Research Service, Washington, D.C.

UPPER ATMOSPHERE AND SPACE RESEARCH

In its Soviet Bloc Res. in Geophys. Astronomy, and Space, No. 209 31 Jul. 1969 p 25-39 refs (See N70-10127 01-34)
Avail: CFSTI

The use of a multi-electrode probe in rarefied plasma is discussed, and a method is described for continuous determination of zero levels for a neutron monitor. Brief summaries are also included for investigations of ionospheric radio propagation, auroral phenomena, galactic origin of cosmic rays, ionospheric disturbances and characteristics of the E and F Regions, and various atmospheric factors affecting artificial satellite performance. A.C.R.

N70-10148# California State Div. of Highways, Sacramento. Materials and Research Dept.

QUANTITATIVE DETERMINATION OF SOIL AND AGGREGATE MINERALS BY X-RAY DIFFRACTION Final Report

Travis W. Smith, M. L. McCauley, J. H. Gamble, and J. Puleo Feb. 1969 66 p refs Prepared in cooperation with Bur. of Public Roads
(PB-184085; M/R-632521) Avail: CFSTI CSCL 08G

The purpose of this research study was to evaluate the X-ray diffraction absorption method of quantifying the crystalline mineral content of soils and rocks. A practical, reasonably accurate method of quantitative analysis by X-ray diffraction was needed at the Materials and Research Laboratory and the diffraction-absorption technique appeared promising. Author (USGRDR)

N70-10150# IIT Research Inst., Chicago, Ill. Technology Center.

ROCK BREAKAGE BY LIGHT-GAS GUN PROJECTILES Final Report

Victor G. Gregson, Jr. and Madan M. Singh 22 Jan. 1969 129 p refs
(Contract DOT-3-0171)
(PB-184191; IITRI-D6000-08) Avail: CFSTI CSCL 13B

The report discusses hypervelocity impact on rock targets using a light-gas gun with Zulux projectiles (solid and water-filled). The specific energies for rock breakage range from 120 to 260 joules/cc (1,400 to 3,200 ft-lb/cu in.) for Indiana limestone, and from 80 to 120 joules/cc (900 to 1,500 ft-lb/cu in.) for Milford Pink granite. Rock descriptions and strength properties are included. Previous work on basalt by Gault (NASA) and Moore (USGS) is included. The specific energies compared to specific energies incurred by other potential drilling techniques indicates that high velocity solid impact is a potential method to increase drilling rates. A potential method is developed to calculate hydrodynamic crater volumes for given impact energies. Author (USGRDR)

N70-10204# Bureau of Reclamation, Denver, Colo. Chemical Engineering Branch.

REVIEW AND BIBLIOGRAPHY ON ROCK SOLUBILITY AND ZEOLITE MINERALS

G. W. DePuy Nov. 1968 66 p refs
(PB-184251; ChE-87) Avail: CFSTI CSCL 08G

A bibliography was prepared and literature reviewed on the solubility of rock and rock-forming minerals, with emphasis on laboratory methods for solubility studies and the solubility of zeolites and calcium carbonate. As solubility is dependent on many variables, the review was limited to the general and more basic considerations rather than to details of specific studies. The structure, composition, geologic occurrence, and chemical stability of zeolites are outlined. The bibliography contains 257 references. An index to the bibliography is included with subject headings on calcium carbonate and carbonate mineral solubility, calcium sulfate solubility, solubility of other substances, solubility theory and data, measurement methods, and zeolites. Author (USGRDR)

N70-10234# Naval Research Lab., Washington, D.C. Radar Geophysics Branch.

A PROPOSED EXPERIMENT TO MEASURE IONOSPHERIC PLASMA DRIFT VECTORS

James B. Mead Jun. 1969 44 p
(AD-692387; NRL-MR-2018) Avail: CFSTI CSCL 4/1

A tristatic Thomson scatter radar experiment is proposed to determine the velocity vector of large scale plasma drifts in the ionospheric F-region. A determination of the drift vector will require measurement of the resulting shifts in the received backscatter doppler spectra as seen from three widely-seperated ground stations. The experiment is planned to be carried out jointly between the Naval Research Laboratory and the Air Force Cambridge Research Laboratory. The Naval Research Laborstorys 150-foot antenna system located at Chesapeake Beach, Maryland is intended for both transmission and reception; similar 150-foot steerable antennas located at Sugar Grove, West Virginia and at the Air Force Cambridge Research Laboratorys field site at Sagsmore Hill, Hamilton, Massachusetts are to be used for reception. Measurement techniques, instrumentation requirements and objectives are discussed as well as limitations and a suggested time scale. A preliminary bistatic experiment between the Randle Cliff Radar and Sagamore Hill to determine feasibility and measure signal strength has been completed successfully. Thomson scatter power profiles were obtained at altitudes between 200 and 1000 km. Author (TAB)

N70-10248# Joint Publication Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 206 13 Jun. 1969 p 28–50 refs (See N70-10245 01-34)
Avail: CFSTI

A survey of the earth's crust by deep seismic sounding in the Sea of Japan was conducted in poorly studied areas of submarine rises. Samples were collected, and sediments were studied by reflected waves. The marine biology of the Baltic is discussed, and the oceanographic data at the World Data Centers are described. F.O.S.

N70-10249# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 206 13 Jun. 1969 p 51–66 refs (See N70-10245 01-34)
Avail: CFSTI

Methods for predicting earthquakes at Tashkent are discussed by reporting certain phenomena that have occurred before tremors. One of these phenomena is the report concerning the hissing of a high voltage discharge in the air at the top of an antenna connected to an electrical cable extending 500 meters down a bore hole into the earth. The disturbance was registered five hours prior to the tremor, and also observed prior to the aftershocks. Another phenomenon considered is the increase of the inert gas radon in the water of an artesian well prior to tremors, and the sharp decrease after the shock. F.O.S.

N70-10250# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 206 13 Jun. 1969 p 67–94 refs (See N70-10245 01-34)
Avail: CFSTI

The problems of why space research is required and what practical advantages are offered mankind and the USSR economy are studied. The benefits of the meteorological and communications satellites are reviewed. One of the grave problems facing mankind is considered the changes in the atmospheric radiation balance, and only the satellite and space research can provide the information for coping with this problem. In addition discussions of rocket technology and physics of the upper atmosphere are presented, and a review of Soviet space achievements is included. F.O.S.

N70-10275# Columbia Univ., New York. Dept. of Geology.
MUD VOLCANO CLAY, TRINIDAD, WEST INDIES
Paul F. Kerr and Darlene S. Richardson 16 Apr. 1969 30 p refs
(Contract AF 19(628)-5550)
(AD-691265; SR-3; AFCRL-69-0050) Avail: CFSTI CSCL 8/7

Laboratory studies of clay mineral samples have been made from two mud volcanoes in the island of Trinidad; Moruga Bouffe and Palo Seco. The mineral content and physical properties have been compared with clay samples from the Lower Cruse and Nariva Formations through which the throats of the mud volcanoes are believed to have penetrated. Author (TAB)

N70-10292# Michigan Univ., Ann Arbor. Coll. of Engineering.
INVESTIGATION OF ATMOSPHERIC ABSORPTION FOR REMOTE SENSING APPLICATIONS Final Report
S. R. Drayson May 1969 27 p refs
(Contract ESSA-E71-68(N))
(PB-184239) Avail: CFSTI CSCL 04A

The report discusses the need for an understanding of atmospheric absorption processes in the interpretation of remote radiance measurements. Specifically included are absorption by the 15 micrometers m carbon dioxide bands, the 14 micrometers m ozone band and the oxygen A-band. Author (USGRDR)

N70-10331# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INTERFEROMETRIC PHASE AND AMPLITUDE FLUCTUATION MEASUREMENTS OVER A 7 KM ATMOSPHERIC PAT
Ernst Gehrels 13 May 1969 36 p refs
(Contract AF-19(628)-5167)
(AD-692438; ESD-TR-69-111; TN-1969-28) Avail: CFSTI CSCL 20/6

A 6328 A laser interferometer of the Michelson type has a one-way path length of 7 km. The fringes are resolved by frequency-modulating the laser sufficiently to sweep over at least one fringe width. By correlation techniques, the resulting fringe intensity pattern is resolved into the true fringe crossing direction and rate and into light amplitude fluctuations. An upper limit of 300 per second is established for the former, the amplitude fluctuations being at a slower rate. With a measured intensity range of up to 5000:1, it is clear from the data that none of the currently postulated Rayleigh, log normal, or Rice distributions match the amplitude statistics over this full range. A limiting value of standard deviation for the log of the amplitude is 0.85. Author (TAB)

N70-10332# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
VERTICAL DISTRIBUTION OF OZONE IN THE WINTER SUBPOLAR REGION
Jagir S. Randhawa White Sands Missile Range, N.Mex. ECOM Jun. 1969 31 p refs
(Contract DA-1-T-061102-B-53-A)
(AD-692298; ECOM-5257) Avail: CFSTI CSCL 4/1

An experiment for the measurement of vertical distribution of ozone in the subpolar region was made at Fort Greely, Alaska. Four rocket-borne ozonesondes were flown during the last week of December 1968. The results show large variations with altitude in the ozone concentration in the lower stratosphere and more ozone than previously theorized near 40km. There is no indication of any significant diurnal variation in the ozone concentration in the upper stratosphere. Author (TAB)

N70-10333# Hawaii Inst. of Geophysics, Honolulu.
CURRENT OBSERVATIONS IN THE HAWAIIAN ARCHIPELAGO
Klaus Wyrtki, Volker Graefe, and William Patzert Jul. 1969 158 p refs
(Contract Nonr-3748(06))
(AD-692439; HIG-69-15) Avail: CFSTI CSCL 8/3

From 1965 to 1969 current measurements with moored current meters were made in the Hawaiian Archipelago for periods of from two to six weeks. Data from each of the 43 current meter stations are given as progressive vector diagrams, frequency distribution of direction and speed, and computed tidal ellipses. The mooring techniques, data reduction, and computation of the tidal ellipses are described. Author (TAB)

N70-10335# Columbia Univ., Dobbs Ferry, N.Y. Hudson Lab.
TRANSDUCER INSTRUMENTATION FOR SURFACE WAVE MEASUREMENT
Harold D. Goldberg and Milton I. Goldberg May 1969 19 p refs
(Contract Nonr-266(84))
(AD-692425; TR-180) Avail: CFSTI CSCL 8/3

The transducer instrumentation system portion of the surface wave system is described. An accelerometer is vertically stabilized by a gyro. This gyro also drives potentiometers which provide pitch and roll outputs. Heading is obtained by a gyro-stabilized saturable inductor magnetometer system. Where a shipborne digital data processor is available, a proposed instrumentation system is outlined. Author (TAB)

N70-10350# Lockheed Missiles and Space Co., Palo Alto, Calif.
SCIENCE EXTENDS THE HORIZON: IN THE SUPERLONG WAVELENGTH RANGE
L. Zhekulin et al 1969 3 p Transl. into ENGLISH from Pravda (Moscow), no. 302(18715), 29 Oct. 1969
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The influence the ionosphere exerts on superlong radio wave propagation is analyzed for wavelengths from several to hundreds of kilometers. In addition another influence is the earth's magnetic lines of force which act as guides for the signals to follow. Experiments investigating superlong wave propagation were conducted with Cosmos-142, and Cosmos-259. Measurements were performed both during passage over the radio station, and at the magnetically conjugate domains. The data have led to the opinion that the upper ionosphere is not homogeneous, but fibrous in structure, with individual fibers oriented along the lines of the earth's magnetic field, and are domains of increased ionization. F.O.S.

N70-10361# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
STRUCTURAL SCHEME OF THE EARTH'S CRUST OF THE URALS FROM GRAVIMETRIC DATA [STRUKTURNAYA SKHEMA ZEMNOY KORY URALA PO GRAVIMETRICHESKIM DANNYM]
A. N. Timofeev et al May 1969 16 p refs Transl. into ENGLISH from Glubinnoye Stroyeniye Urala (Moscow), 1968 p 101–108
(AD-692095; ACIC-TC-1528) Avail: CFSTI CSCL 8/7

The report is a discussion of the gravimetric investigations dealing with the Urals. It is indicated that the gravity anomalies within the limits of the exposed parts of the Urals are primarily connected with nonuniformities in the composition of the upper part of the crust. The most intensive positive anomalies are caused cy considerable masses of rocks of basic composition reaching great depths, and negative anomalies are primarily caused by thick granitic intrusions and sedimentary series of the Sub-Ural trough. Considerable horizontal non-uniformities are smoothed out in the lower part of the earths crust. Author (TAB)

N70-10373# Army Dept., Washington, D.C.
GREAT LAKES ICE ATLAS
Donald R. Rondy Apr. 1969 53 p refs
(AD-692310; RR-5-6) Avail: CFSTI CSCL 8/12

A series of 33 charts is presented to illustrate the ice cover on the Great Lakes for three classifications of winter: mild, normal, and severe. The freezing degree-day concept was employed to make these classifications. One meteorological station on each lake was selected that would reflect a lakewide freezing degree-day accumulation, based on daily average temperatures for ten years from 32 meteorological stations. Twenty years of temperature records from the selected representative stations were examined to determine a classification for the winter season. Six ice charts are presented for each of the Great Lakes. Four charts illustrate the characteristic patterns and extent of ice cover during a normal winter, with the first chart portraying the ice cover during an early development stage, the second during an advanced stage at mid-season, the third depicting the ice distribution during the period of maximum ice cover, and the fourth chart indicating the ice cover patterns during the early decay period. Two charts show the maximum extent of ice cover during the mild and severe winters. The ice cover on Lake St. Clair is portrayed by three charts during a normal winter; the early development stage, maximum ice cover, and the decay period. Author (TAB)

N70-10389# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: FREIBURG, URSI-CODE 131 [IONOSPHAEREN-DATEN, VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE-131]
Jul. 1969 45 p In GERMAN and ENGLISH
(Rept-277-F) Avail: CFSTI

The hourly observations in ionic variations for July 1969 are tabulated. F.O.S.

N70-10464# Oceanics, Inc., Plainview, N.Y.
THE ESTIMATION OF VECTOR WAVENUMBER SPECTRA BY MEANS OF DATA OBTAINED FROM A RAPIDLY MOVING HYDROFOIL VEHICLE Final Technical Report, 1 Jan. 1968 – 31 Jul. 1969
Willard J. Pierson, Jr. and Alfred I. Raff Nov. 1968 52 p refs
(Contract N00014-68-C-0285)
(AD-692124; TR-68-56) Avail: CFSTI CSCL 8/3

A method is presented for the estimation of the vector wavenumber spectrum and the directional wave spectrum of the sea surface elevation. The method assumes that an athwartship array of wave height sensors are mounted on a rapidly moving foil-borne hydrofoil vehicle and that simultaneous surface elevation records are obtained from each sensor. The estimated wave spectrum is expressed in terms of the encounter spectrum and the set of encounter cross-spectra obtained from these records. The method is evaluated by means of an artificial analytical example (without sampling variability). It appears that a wide range of wave frequencies can be resolved quite well. The basic limitation is the length of the array with respect to the longer wave lengths in the spectrum. Author (TAB)

N70-10487# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
OBSERVATIONS OF SHORT PERIOD INTERNAL WAVES IN MASSACHUSETTS BAY
David Halpern (Ph.D. Thesis) Jan. 1969 111 p refs
(Contract Nonr-1841(74))
(AD-692184) Avail: CFSTI CSCL 8/3

Short period (7-minutes) temperature fluctuations were measured in 82 m of water from instrumented buoys moored 9 km west of a prominent sill in Massachusetts Bay. The high frequency oscillations begin with a large abrupt rise in temperature and persists for about three hours. The average time interval between the onset of successive groups of high frequency fluctuations was 12.4 hours. Prior to their onset the temperature is steady. The high frequency fluctuations are coherent and of uniform phase in the vertical direction. The distribution of the rms vertical displacements corresponds to the eigen-function of the first mode of internal waves, which was computed from measurements of density and velocity. Long crested, short wavelength, dark narrow surface bands were related to the high frequency temperature fluctuations. Groups of high frequency large amplitude fluctuations occurred in velocity measurements made 200 m from the temperature instrumented buoys. The high frequency fluctuations occurring at regular intervals of time seem to be internal waves of mode one propagating in the same direction with respect to the moving medium. Author (TAB)

N70-10480# Army Foreign Science and Technology Center, Washington, D.C.
USE OF AERIAL PHOTOGRAPHY IN STUDYING FOREST TYPES
G. G. Samolovich 1969 28 p refs Transl. into ENGLISH from the Russian
(AD-692360; FSTC-HT-23-285-68) Avail: CFSTI CSCL 2/6

The method of aerial photography, in combination with terrestrial geobotanic studies, can serve as a reliable means for delineating and mapping forest types and to speed up and reduce the cost of such studies. Author (TAB)

N70-10520# International Institute for Aerial Survey and Earth Sciences, Delft (Netherlands).
TERRAIN TRAFFICABILITY EVALUATION USING AERIAL PHOTOGRAPHS: A MODIFIED APPROACH
A. R. Nataraj Jul. 1969 47 p refs /ts Ser. B, No. 52
Avail: CFSTI

Trafficability of a terrain is controlled by various factors like slope, vegetation, soil strength and micro-relief. These factors are inter-related and tend to be uniform within a land system. Using aerial photographs they can be evaluated and their effects on trafficability can be estimated. The estimated effects can be grouped following a pre-determined trafficability scale. The overall trafficability conditions pertaining to a region can be represented on overlays to a topographic map. The trafficability legend of these overlays can be kept simple. Author

N70-10622# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
GEOPHYSICAL INVESTIGATIONS OF THE STRUCTURE OF THE EARTH'S CRUST IN THE ATLANTIC OCEAN REGION [GEOFIZICHESKIE ISSLEDOVANIYA STROENIYA ZEMNOI KORY V OBLASTI ATLANTICHESKOGO OKEANA]
A. G. Gainanov et al Aug. 1969 10 p Transl. into ENGLISH from the Russian
(AD-692099; ACIC-TC-1568) Avail: CFSTI CSCL 8/7

The paper discusses the gravity field of the northern part of the Atlantic Ocean. The character of gravity anomalies divides the area into three basis groups - areas of deep oceanic troughs, areas of underwater ridges and oceanic islands and the transition zone from the ocean to the continents. When passing from the Atlantic Ocean to the continents of North and South America, Europe and Africa the values of the free-air anomalies decrease from -50--100 mgal and then increase to +50--70mgal. The Bouguer isoanomaly lines are denser in the transition zone and a considerable gravity gradient is created. Since there are more than 200 seismic points in the Atlantic Ocean where the depth of the M discontinuity has been determined, gravimetric data has also become more abundant. Investigations to determine relation between Bouguer gravity anomalies and the thickness of the earths crust can now be made separately for the deep parts of the ocean, and for the transition zones from the ocean to the continents. Author (TAB)

N70-10633# Army Foreign Science and Technology Center, Washington, D.C.
COMPLEX MECHANIZATION EXCAVATION IN PERMAFROST [KOMPLEKSNO-MEKHANIZIROVANNAYA RAZRABOTKA VECHNOMERZLYKH GRUNTOV]
G. D. Dakhno 1969 121 p refs Transl. into ENGLISH from the Russian
(AD-692487; FSTC-HT-23-223-69) Avail: CFSTI CSCL 13/13

The book presents a short analysis of different methods of preparing permafrost ground for excavation. The use of trenches, pits and vertical systems is discussed as well as thawing by radiation and the excavation of non-metallic materials. Author (TAB)

N70-10636# Institute of Technology, Helsinki (Finland).
THE BEHAVIOUR OF ROCK UNDER IMPULSE LOADS. A STUDY USING THE HOPKINSON SPLIT BAR METHOD
K. O. Hakalehto (Ph.D. Thesis) Finn. Acad. of Tech. Sci. 1969 83 p refs Acta Polytech. Scand.
(PB-184602; APS-CH-81) Avail: CFSTI CSCL 08G

The behaviour of Tennessee Marble, Charcoal Granite and sandstone specimens under impulse loads of 65 and 35 microsecs duration was studied by using the Hopkinson split bar method. The study of the actual behaviour of rock during fracture was possible as no transducers were attached to the specimens themselves. Author (USGRDR)

N70-10648# Columbia Univ., Dobbs Ferry, N.Y. Hudson Labs.
MEASUREMENT OF THE STATISTICAL PROPERTIES OF THE OCEAN SURFACE WITH INSTRUMENTED SURFACE FLOATS. PART 1: THEORY OF MEASUREMENTS
R. Alfred Saenger May 1969 59 p refs
(Contract Nonr-266(84))
(AD-692426; TR-183-Pt-1) Avail: CFSTI CSCL 8/3

Gyro-stabilized vertical accelerometer-roll-pitch-heading floats plus special analog processing and digital recording equipment have been developed to measure roughness properties of the ocean surface associated with gravity wave components up to 1 Hz. A group of interconnecting computer processing routines, some of which incorporate the FFT, have been created to check, transform, and process large amounts of field data. Part I contains a general description of the effort and a detailed account of the informational capabilities of float systems. From dynamical considerations it is shown that the three-dimensional motion of a typical surface particle can be reconstructed from float time series. After a review of the linear random model due to Pierson et al., it is shown how energy flux and effective group velocity of wave components in narrow frequency bands can be computed from float data. Finally, the Longuet-Higgins, Cartwright, Smith method of determining smoothed directional spectra is reviewed. Author (TAB)

N70-10572# Army Foreign Science and Technology Center, Washington, D.C.
MORPHOLOGY AND GENESIS OF GLACIERS IN CENTRAL TRANSBAYKALIYA
Yu. V. Mudrov 9 Aug. 1969 21 p refs Transl. into ENGLISH from Russian J.
(AD-692373; FSTC-HT-23-489-68) Avail: CFSTI CSCL 8/12

The morphology and genesis of ice formations in Central Transbaykaliya are discussed. The author classifies two types of ice formations which are prevalent in Central Transbaykaliya: channel ice formations, which occur on rivers and streams; ground ice formations, which are derived from two types of ground waters, specifically, sub-frozen ground waters and above-frozen ground waters. The author also describes means by which the various types of ice formations can be identified and predicted. Author (TAB)

N70-10574# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
MESO-CENOZOIC HISTORY AND CRUSTAL STRUCTURE OF THE OKHOSK REGION [MEZO KAINOZOISKAYA ISTORIYA I STROENIE ZEMNOI KORY OKHOTSKOGO REGIONA]
M. S. Markov et al Jun. 1969 346 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Geol. Inst. Tr. (USSR), no. 168, 1967 p 1-224
(AD-692209; ACIC-TC-1406) Avail: CFSTI CSCL 8/7

The work represents the results of the first stage of geological-geophysical studies of the Okhotsk region. The basic aim was the construction of a tectonic scheme of the region, the explanation of the history of development of the different structural zones, as well as the character of the depth structure of the earths crust. In the second part of the study, the intention is to analyze in detail the properties of magnetic manifestations and their connections with the character and history of development of basic tectonic structures. On the basis of geological and geophysical data, a new scheme of the tectonic zonation of the floor of the Sea of Okhotsk and adjacent land compartments is suggested. Investigations of the structural features of the earths crust of regions with a different history of geological development and depth structure prove that in this section of the western part of the Pacific Ocean a gradual increase of the continent is taking place through the compartments of the oceanic floor being drawn into the geosynclinal process and due to the formation of the granitic layer of the earths crust during this process. Author (TAB)

N70-10576# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. für Physik der Atmosphäre.
INVESTIGATIONS ON ARTIFICIAL RADIOACTIVITY IN THE FREE ATMOSPHERE [UNTERSUCHUNGEN DER KUENSTLICHEN RADIOAKTIVITAET IN DER FREIEN ATMOSPHAERE]
H.-F. Fischer, D. Paffrath, and W. Peters Jun. 1969 110 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-38; DVL-877) Avail: CFSTI

Flight measurements were performed to investigate the artificial radioactivity in free atmosphere by sampling aerosols on fiber filters. Aerosol sampling devices, especially a semi-automatic filter changer were developed. The beta-activity and the gamma-energy spectrum of the samples were measured and beta-decay curves were analysed. Besides routine measurements of the radio-activity in the lower stratosphere, vertical concentration distribu-tions of the artificial radioactivity of fresh and old fission products were established during the passage of radioactive particle clouds originating from the Chinese nuclear test explosions. Author (ESRO)

N70-10583# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LASA DECISION PROBABILITIES FOR MS-MB AND MODIFIED SPECTRAL RATIO
Richard T. Lacoss 23 Jul. 1969 29 p refs
(Contract AF 19(628)-5167; ARPA Order -512)
(AD-692451; TN-1969-40; ESD-TR-69-207) Avail: CFSTI CSCL 17/10

LASA data have been analyzed to determine the probabilities that MS - mb and Modified Spectral Ratio (MSR) can be effectively applied to seismic events. The probabilities have been estimated as a function of magnitude and whether the event is an explosion or an earthquake. In the case of the earthquakes, the probabilities go from about 1.0 to 0.0 as mb goes from 5.0 to 4.0. The drop is slightly faster for MS - mb. MSR behaves similarly for explosions. However, the probability for MS - mb in the case of explosions drops to zero roughly over the range of mb from 5.2 to 4.5. In addition, a limited study of joint properties of MS - mb and MSR has indicated that they operate quite independently in the sense that if one of the discriminants yields no decision concerning a particular event, the probability that the other can make a decision is not significantly affected. Author (TAB)

N70-10585# Naval Postgraduate School, Monterey, Calif.
THE T-S GRADIENT METHOD, A NEW METHOD OF COMPUTING GEOSTROPHIC CURRENTS OVER LARGE OCEAN AREAS
Warren Wilson Denner Jun. 1969 202 p refs
(AD-692450; NPS-58DW9072A) Avail: CFSTI CSCL 8/3

Requirements for indirect computation of geostrophic surface currents over large ocean areas are discussed. These requirements point to a need to simplify standard geostrophic computations, and to separate the first order thermal and haline contributions to geostrophic flow. The equations of motion for geostrophic flow are reviewed and the standard geostrophic computations discussed. Errors and limitations in the geostrophic method are reviewed. Previous attempts to simplify geostrophic computations are discussed and shown to be inadequate for synoptic computation over hemispheric ocean areas. It is shown that the Helland-Hansen equation can be rewritten such that the geostrophic velocity is composed of a temperature structure term and a salinity structure term. Author (TAB)

N70-10604# Army Foreign Science and Technology Center, Washington, D.C.
EXPERIENCE IN MAKING USE OF SPECTROZONAL PHOTOGRAPHS IN A TOPOGRAPHIC SURVEY ON A 1:25.000 SCALE
B. I. Ignatev 9 Aug. 1969 9 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 1, Jan. 1967 p 43–45
(AD-692362; FSTC-HT-23-689-68) Avail: CFSTI CSCL 8/2

Color spectrozonal aerial photographs were used to decipher and identify points in plan-altitude field training. No particular advantage of these were noted over black and white photographs for this purpose, although color does possess a great advantage over black and white in topographical decipherment. The possibility of using small-scale color photography for decipherment in sparsely populated areas is suggested. Author (TAB)

N70-10627# National Committee for Space Research, Haifa (Israel). Radio Observatory.
IONOSPHERIC RESEARCH USING SATELLITES Final Scientific Report, 1 Dec. 1964 – 31 Jan. 1969
Jonathan Mass and Zwi Houminer 28 Feb. 1969 39 p refs
(Contract AF 61(052)-837)
(AD-691911; AFCRL-69-0314) Avail: CFSTI CSCL 4/1

Ionospheric electron content above Haifa was determined for the period of November 1964 – June 1966, from observations of the S-66 satellite. Diurnal and seasonal variations in electron content as well as solar and magnetic activity dependence are discussed. Some results are given concerning slab thickness and horizontal gradients in electron content. Amplitude recordings of the 136 MHz transmissions of the Canary Bird synchronous satellite were analysed for scintillations for the period December 1967 – January 1968. Diurnal variations and probability distributions of amplitude scintillations for this period are presented. Author (TAB)

N70-10628# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
MOTION OF THE EARTH'S POLES AND ASTRO-GEODETIC WORKS [DVIZHENIE POLYUSOV ZEMLI I ASTRONOMOGEODEZICHESKIE RABOTY]
I. D. Zhongolovich Jun. 1969 13 p Transl. into ENGLISH from the Russian
(AD-692098; ACIC-TC-1541) Avail: CFSTI CSCL 8/5

The report deals with the detailed derivation of formulas necessary for the accounting of the influence of the poles motion upon the latitude, longitude, and azimuth determinations, as well as geocentric rectangular coordinates of the points of the earths surface. Author (TAB)

N70-10631# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
DEEP-SEATED STRUCTURE OF THE URALS AND ADJACENT REGIONS [GLUBINNAYA STRUKTURA URALA I SOPREDEL NYKH REGIONOV]
I. S. Ogarinov Jun. 1969 18 p refs Transl. into ENGLISH from Glubinnoye Stroyeniye Urala (Moscow), 1968 p 109–116
(AD-692096; ACIC-TC-1529) Avail: CFSTI CSCL 8/7

The work discusses the data put forth by several scientists regarding the deep-seated structure of the Urals and adjacent areas. A joint analysis of these schemes and data of deep seismic soundings carried out in recent years show considerable basic discrepancies. In computing the depths of occurence of the M surface the authors used either too general correlations between regional anomalies of gravity field and the earth crust thickness compiled for large areas of the country, or correlations compiled for small regions were used for studying the structure of the earth crust of a large area. The peculiarities in the structure of the earth crust, inherent to some regions, was not taken into consideration. An accepted point of view, explaining the geological development of the earth crust is discussed. Author (TAB)

N70-10632# National Bureau of Standards, Washington, D.C.
A REVIEW OF RATE CONSTANTS OF SELECTED REACTIONS OF INTEREST IN RE-ENTRY FLOW FIELDS IN THE ATMOSPHERE

M. H. Bortner May 1969 66 p refs Sponsored by ARPA
(AD-692231; NBS-TN-484) Avail: CFSTI; SOD: $0.60 CSCL 4/1

The major reactions normally encountered in flow field re-entry calculations for the oxygen nitrogen system are reviewed and a rate constant value for each reaction is recommended. Collisional ionization processes, charge exchange reactions and attachment-detachment reactions are included. Rate constant coefficients are reported in tabular form for the selected rate constant. The data are also graphed as log k vs T(K). In all, over twenty forward and reverse reactions are reviewed. Additionally, a large number of rate constant values for reactions which also effect flow field calculations are given. Author (TAB)

N70-10645# Joint Publications Research Service, Washington, D.C.

SCIENTISTS INVESTIGATE WAVE MOTION PROBLEMS

25 Aug. 1969 27 p refs Transl. into ENGLISH from Russian publications
(JPRS-48682) Avail: CFSTI

CONTENTS:

1. LIMITS OF APPLICABILITY OF THE CONCEPT OF "EQUIVALENT RADIUS" OF THE EARTH V. A. Andrianov p 1-8 refs (See N70-10646 01-13)

2. ATMOSPHERIC ABSORPTION OF RADIO WAVES IN THE ZONE OF ROTATIONAL RESONANCE OF WATER VAPOR LAMBDA APPROXIMATELY 1.35 cm V. M. Plechkov p 9-14 refs (See N70-10647 01-13)

3. THEORY OF WAVE FLUCTUATIONS AND SCATTERING IN A PLASMA IN STRONG ELECTRIC AND MAGNETIC FIELDS I. A. Akhiyezer et al p 15-24 refs (See N70-10648 01-25)

N70-10646# Joint Publications Research Service, Washington, D.C.

LIMITS OF APPLICABILITY OF THE CONCEPT OF 'EQUIVALENT RADIUS' OF THE EARTH

V. A. Andrianov *In its* Scientists Investigate Wave Motion Probl. 25 Aug. 1969 p 1-8 refs Transl. into ENGLISH from Radiotekhn. i Elektron. (Moscow), no. 2, 1969 p 195-200 (See N70-10645 01-13)
Avail: CFSTI

The problem of applicability of the equivalent radius concept was studied when calculating a field of ultrasonic wave diffraction around the earth. The encircling atmosphere was the function of the altitudes above the earth's surface. Author

N70-10647# Joint Publications Research Service, Washington, D.C.

ATMOSPHERIC ABSORPTION OF RADIO WAVES IN THE ZONE OF ROTATIONAL RESONANCE OF WATER VAPOR lambda APPROXIMATELY EQUAL TO 1.35 cm

V. M. Plechkov *In its* Scientists Investigate Wave Motion Probl. 25 Aug. 1969 p 9-14 refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radiofiz. (Gorkiy), v. 12, no. 2, 1969 p 185-188 (See N70-10645 01-13)
Avail: CFSTI

The results of experimental investigation of the vertical absorption of radio waves lambda approximately 1.2-1.5 cm by molecules of atmospheric water vapor and oxygen with respect to the natural radio-frequency radiation of the atmosphere are reported. It is demonstrated that the absorption coefficient of water vapor near rotational resonance lambda, approximately 1.35 cm obtained from measuring the vertical absorption. The experimental absorption coefficients of radio waves in the 1.2-1.5 cm range in oxygen at sea level exceed their theoretical values by 28 percent on the average. Author

N70-10659# Joint Publications Research Service, Washington, D.C.

OCEANOGRAPHY

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 204 14 May 1969 p 28-40 refs (See N70-10656 01-34)
Avail: CFSTI

Possible applications of hydroacoustic techniques in oceanography are mentioned, as well as klystron generators for subnanosecond pulses to measure ice thickness. Brief summaries of articles on ocean bottom topography, drift currents, underwater acoustic propagation; and water temperature and salinity conditions in sea and ocean water are also included. A.C.R.

N70-10662# Joint Publications Research Service, Washington, D.C.

MISCELLANEOUS

In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 204 14 May 1969 p 75 refs (See N70-10656 01-34)
Avail: CFSTI

Topographic and hydrographic surveys in the area surrounding the Soviet Antarctic station at Molodezhnaya are reported. Operations involved in establishing a permanent base at this site are also mentioned. A.C.R.

N70-10667# Groupe de Recherches Ionospheriques, Issy-les-Moulineaux (France).

PRELIMINARY REPORT ON THE FU 171 EXPERIMENT AT KERGUELEN-SOGRA, FEBRUARY-APRIL 1968 [COMPTE RENDU PRELIMINAIRE SUR L'EXPERIENCE FU 171, KERGUELEN-SOGRA, FEVRIER-AVRIL 1968]

R. Gendrin Nov. 1968 49 p IN FRENCH
(GRI-NTP-37) Avail: CFSTI

FU 171 aimed at studying mechanisms of the generation of radioelectric very low frequency waves in the magnetosphere. Simultaneous ground measurements have been recorded at the Kerguelen and the Sogra (USSR) stations, to ascertain the interactions between waves and energetic particles which are either trapped or precipitated. Two perpendicular antennas are used to detect electromagnetic waves and four particle detectors are used to measure electron and proton distribution along the axis of the rocket and perpendicularly to this direction. ESRO

N70-10702# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INTERFERENCE AND SPECTRA OF WAVES IN SEISMIC PROSPECTING

M. E. Hryn Mar. 1969 118 p refs Transl. into ENGLISH from Interferentsiya i Spektry Khvyl U Seismorozvidtsi (Kiev), 1965 p 1-128
(AD-690009; FTD-HT-23-288-68) Avail: CFSTI CSCL 8/7

The monograph is devoted to certain aspects of the formation and separation of seismic interference waves primarily by means of the Fourier integral expansion of signals into spectral densities. The first chapter reviews the literature on the study of waves in interference zones. The most important factors affecting wave formation, the excitation spectra, the effect of a medium on the shape of the spectrum during wave propagation, are evaluated. The second chapter discusses the spectral theory of the interference of two waves and describes the dependence of their characteristics on the frequency and phase compositions of the sum of the signals. Chapter three describes a method of constructing phase travel-time curves for quasi-sinusoidal signals and an approximate (iteration) method for determining amplitudes. Formulas are derived for the evaluation of amplitudes from the characteristic point values of a sum wave. The book closes with a description of some results of modeling experiments and field investigations conducted in the Karpatskiy foredeep. Author (TAB)

N70-10718# Bonn Univ. (West Germany). Physikalisches Inst.
EXPERIMENTS TO DETERMINE DENSITY AND COMPOSITION OF THE ARCTIC THERMOSPHERE [VERSUCH EINER MESSUNG VON DICHTE UND ZUSAMMENSETZUNG DER ARKTISCHEN THERMOSPHAERE]
G. Pfeiffer and U. v. Zahn Jul. 1969 59 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fur Wiss. Forsch.
(BMWF-FB-W-69-26) Avail: CFSTI

On Oct. 4, 1967 two sounding rockets were launched in an attempt to measure latitudinal variations in the state of the upper atmosphere. The ESRO payloads D34/1 and S19/1 took off from Andoya (69N) and Sardinia (40N) respectively carrying 2 monopole spectrometers, each from the University of Bonn for the determination of density and composition of the neutral thermosphere. Unfortunately, the spectrometers of D34/1 were opened at much too high a pressure and thus the quality of the data obtained was heavily impaired. This report presents the data analysis for D34/1. One result is that the ratio n(He)/n(N2) was about 3 × 10 to the minus 3 power at 200 km for both flights D34/1 and S19/1. Furthermore, a program is described which allows computer decommutation of commutated data channels.
Author (ESRO)

N70-10733# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
BIBLIOGRAPHY ON SOIL DYNAMICS
R. K. Bernhard Jun. 1969 102 p refs
(AD-692290; CRREL-SR-110) Avail: CFSTI CSCL 08/13

Books, papers, bibliographies and symposium proceedings concerning soil dynamics are listed, each with an accompanying annotation describing its contents. The items listed were published from 1961 to 1965.
Author (TAB)

N70-10740# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Abteilung fur Weltraumphysik.
FEASIBILITY STUDY ON THE CALCULATION OF THE INTEGRAL ELECTRON CONTENT OF THE UPPER ATMOSPHERE AND PROPOSAL FOR A NEW-STYLE BEACON EXPERIMENT IN ORDER TO DETERMINE THE INTEGRAL ELECTRON CONTENT FOR THE IONOSPHERE AND MAGNETOSPHERE UP TO 36,000 km USING SIGNALS FROM GEOSTATIONARY SATELLITES [STUDIE UEBER MOEGLICHKEITEN ZUR ERMITTLUNG DES INTEGRALEN ELEKTRONENINHALTES DER HOHEN ATMOSPHAERE UND VORSCHLAG FUER EINE NEUARTIGE VERSUCHSANORDNUNG ZUR BESTIMMUNG DES INTEGRALEN ELEKTRONENINHALTES FUER IONOSPHAERE UND MAGNETOSPHAERE BIS 36.000 km MIT HILFE EINES GEOSTATIONAEREN SATELLITEN]
W. Dieminger, G. K. Hartmann, and G. Schmidt Jul. 1969 59 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fur Wiss. Forsch.
(BMWF-FB-W-69-28) Avail: CFSTI

By using the beacon frequencies of a geostationary satellite with frequency ranges >130 MHz it can be shown that above 5000 km the upper atmosphere does not contribute measurably to the Faraday rotation angle. This is due to the weighting of the earth's magnetic field and the decrease in electron content with increasing altitude. The so-called differential Doppler is not affected by the above mentioned weighting function and therefore $\int N ds$ is measurable along the total range up to 36,000 km, the distance of the geostationary satellite. In order to measure this quantity, the total electron content up to 36,000 km, a new method is proposed.
Author (ESRO)

N70-10752# Groupe de Recherches Ionospheriques, Issy-les-Moulineaux (France).
ELECTRON DENSITY MEASUREMENTS ONBOARD SATELLITE FR-1 [MESURES DE DENSITE ELECTRONIQUE A BORD DU SATELLITE FR-1]
J. M. Baguette Sep. 1968 41 p refs In FRENCH
(GRI-NT-76) Avail: CFSTI

Two distinct methods have been used with the FR-1 satellite to measure electron density: observation of the Doppler effect on an artificial VLF wave received by the satellite and measurement of the HF current in an impedance probe. A comparison of the results shows a systematic variation between the two methods.
ESRO

N70-10783# Ionospharen-Institut Breisach (West Germany).
ANALYSIS OF IONOSPHERIC DRIFTS OBSERVED AT DIFFERENT LATITUDES Final Report, 1 Apr. 1966–28 Feb. 1969
Ewald Harnischmacher and Karl Rawer 31 Mar. 1969 172 p refs
(Contract AF 61(052)-944)
(AD-691913; IIB-21; AFCRL-69-0265) Avail: CFSTI CSCL 4/1

Drift observations by the Krautkramer method from Dapango (Togo), Mayaguez (Puerto Rico) and Freiburg (Germany) are analyzed and compared after reduction to quarterly statistics. Near the magnetic equator the drift shows continuous changes of the direction so that it is not entirely zonal. At low temperate latitude the solar diurnal component is the most important one; absolute speed values are considerable smaller than at higher temperate latitude. The predominant rotational sense of the semidiurnal components is always right hand at higher latitude but becomes left handed at lower temperate latitude in summer and fall.
Author (TAB)

N70-10786# Institut Royal Meteorologique de Belgique, Brussels. Inst. d'Hygiene et d'Epidemiologie.
ATMOSPHERIC POLLUTION, SMOKE AND SULFUR DIOXIDE Monthly Bulletin, Feb. 1969 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX Bulletin Mensuel, Février 1969]
1969 22 p In FRENCH and DUTCH
Avail: CFSTI

Tables are given of sulfur dioxide and smoke quantity (air pollution) measured at different Belgian weather stations in February 1969. A brief description is given of the air sampling apparatus.
Author (ESRO)

N70-10808# Institut Royal Météorologique de Belgique, Brussels.
OZONE OBSERVATIONS Quarterly Bulletin No. 4, 1967 [OBSERVATIONS D'OZONE Bulletin Trimestriel Numéro 4, 1967]
1969 9 p ref In FRENCH and DUTCH
Avail: CFSTI

An atmospheric cooperative ozone sounding program using Brewer-Mast probes has been carried out between the Belgian Royal Meteorological Institute, the Laboratorium fur Atmosphärenphysik, E.T.H., Zurich, and the Institut für Meteorologie und Geophysik der Freien Universität, Berlin and the Meteorologisches Observatorium, Hohenpeissenberg. This report deals with the measurements made by the Belgian Group during the last quarter of 1967.
ESRO

N70-10812# Institut Royal Météorologique de Belgique, Brussels. Inst. d'Hygiène et d'Epidémiologie.
ATMOSPHERIC POLLUTION, SMOKE AND SULFUR DIOXIDE Monthly Bulletin, Jan. 1969 [POLLUTION ATMOSPHERIQUE, FUMEE ET ANHYDRIDE SULFUREUX Bulletin Mensuel, Janvier 1969]
1969 15 p In FRENCH and DUTCH
Avail: CFSTI

Tables are given of sulfur dioxide and smoke quantity (air pollution) measured at different Belgian weather stations in January 1969. A brief description is given of the air sampling apparatus.
Author (ESRO)

N70-10825# Institut Royal Meteorologique de Belgique, Brussels.
GEOPHYSICAL OBSERVATIONS Monthly Bulletin, May 1969 [OBSERVATIONS GEOPHYSIQUES Bulletin Mensuel, Mai 1969]
1969 41 p In FRENCH and DUTCH
Avail: CFSTI

Data are given from the geophysical observatories in Belgium related to: geomagnetism, air radioactivity, ionospheric parameters, seismology, atmospheric electricity and cosmic rays for May 1969.
ESRO

N70-10835# Johns-Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
A NOTE ON THE EFFECT OF DISPERSION ON MEAN CURRENT MEASUREMENTS
Akira Okubo Jun. 1969 26 p refs
(Contract Nonr-4010(11))
(AD-691242; TR-55) Avail: CFSTI CSCL 8/3

The difficulty with drift type current measuring devices is that they move in a random way with respect to the mean current. Thus, when a small number of current followers are used, the values of mean current derived from the observations do not necessarily represent the true values which could be approximated more clearly by a large number of drift devices. In light of the present knowledge of oceanic diffusion, statistical errors associated with current measurement of this type may be estimated. These errors are generally of the order of 1 cm/sec, but may, in some cases, be as large as 10 cm/sec. The statistical problem can be solved partially by the use of tracers; dye tracers have proved to be quite useful in measuring the mean current as well as in studying diffusion. One must, however, be careful not to interpret the movement of dye patches simply as indicative of the mean current. A knowledge of turbulent diffusion is also needed.
Author (TAB)

N70-10839# Stanford Univ., Calif. Stanford Electronics Labs.
A REVIEW OF LINE-OF-SIGHT PROPAGATION STUDIES OF THE SMALL-SCALE STRUCTURE OF THE ATMOSPHERE
Robert W. Lee May 1969 33 p refs
(Contract F19628-68-C-0055)
(AD-691274; SU-SEL-69-031; SR-2) Avail: CFSTI CSCL 20/14

The present state of theory and experiment are reviewed. Theory is adequate for line-of-sight propagation in weakly inhomogeneous media, and treats a wide variety of situations with potential for the probing of small-scale atmospheric phenomena, using acoustic, microwave and optical transmission. Thus far experiments have served mainly as tests of theory; useful information about the atmosphere will follow upon more intensive concern with the interpretive aspects of the problem.
Author (TAB)

N70-10842# Army Foreign Science and Technology Center, Washington, D.C.
EXPERIENCE IN LARGE-SCALE LANDSCAPE INTERPRETATION AND MAPPING OF KEY SECTORS IN THE ARID AND SUBARID ZONES OF CENTRAL ASIA AND KAZAKHSTAN
B. V. Vinogradov 8 Aug. 1968 37 p refs Transl. into ENGLISH from Russian Report
(AD-692374; FSTC-HT-23-505-68) Avail CFSTI CSCL 8/2

The paper is a presentation of some results in an experiment with large-scale landscape mapping based on the interpretation of aerial photographs taken during geological, soils and hydrogeological studies in western Turkmenia and in Northern and Western Kazakhstan in 1952-1958. Although the recommendations in this paper on landscape mapping are to a considerable extent local, they can be useful for comparison with results in other geographic areas when solving other problems. The author deals with all the basic problems involved in landscape mapping, such as scales and accuracy. In the text a number of aerial photographs are accompanied by landscape maps compiled on the basis of these photographs. These landscape maps in turn are fully analyzed in the text as examples of the application and problems of landscape mapping. The author demonstrates the complexity in interpreting aerial photographs because of the spatial and functional correlations among the individual elements, such as geology, soils, vegetation and hydrogeology. The methods used in compiling such methods are described and the possible applications of such maps in the national economy are discussed.
Author (TAB)

N70-10859 National Lending Library for Science and Technology, Boston Spa (England).
ON A MODEL OF THE INTERACTION BETWEEN LARGE-SCALE PROCESSES IN THE OCEAN AND ATMOSPHERE
A. I. Duvanin [1969] 18 p refs Transl. into ENGLISH from Okeanologiya (Moscow), no. 8, 1968 p 571-580
(NLL-M-7653-(5828.4F)) Avail: Natl. Lending Library, Boston, Spa, Engl.

The interactions between the large scale circulations in the ocean and the atmosphere which transmit heat towards high latitudes on both sides of the equator are studied. To show the long term nonuniformity in the amount of heat carried by currents, and the time intervals with which their propagation from one region to another is connected, the relationship in the Faeroe-Shetland Channel and fluctuations in the level of the North Sea are cited to indicate that changes in the warm North Atlantic Current can be traced by data on the height of the mean level of the North and Baltic Seas. A simple model for studying the dynamic and thermal interaction is described, and is used to show that it is necessary for systematic observation to cover some belt along the basic currents where the processes are clearly marked for determining regularities in warm advection in the hydrosphere.
F.O.S.

N70-10896# International Training Centre for Aerial Survey, Delft (Netherlands).
ON THE OCCASION OF PUBLICLY ACCEPTING HIS OFFICE OF LECTOR IN AERIAL PHOTOGRAPHY AND SURVEY NAVIGATION AT THE INTERNATIONAL INSTITUTE FOR AERIAL SURVEY AND EARTH SCIENCES
Francois Corten Feb. 1969 22 p Presented at Delft, 27 Feb. 1969
Avail: CFSTI

The technology of aerial photography and survey navigation is described and essential conditions for producing qualitative and quantitative measures of the surveyed object are outlined. The use of large scale integrated electronic circuits will improve flight performance and photogrammetric accuracy considerably.
G.G.

N70-10904# Washington Univ., Seattle. Dept. of Oceanography.
THE WAVE DRIFT CURRENT IN A RANDOM GRAVITY WAVE FIELD
Norden E. Huang 1969 14 p refs
(Contract AT(45-1)-1725)
(PB-185362; CONTRIB-000-RLO-1725-145) Avail: CFSTI CSCL 08C

A simple method is used to formulate the second-order drift current induced by random wave motion. The formula relates the drift current, which is equal to the second-order Lagrangian velocity, with the wave-number frequency spectrum of the random wave field. Special cases can be derived readily from the general formula. For single wave train, the drift current is found to be the same as Stokes' classical expression.
Author (USGRDR)

N70-10954# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
SHOCK TUBE EXPERIMENTS ON SNOW

James L. Smith Jun. 1969 22 p refs
(AD-692291; CRREL-TR-218) Avail: CFSTI CSCL 8/12

Hugoniot curves were generated by measuring the pressures and velocities of a series of elastic shock waves that represent final shock states. A shock tube was employed to create a controlled shock pressure that was applied to the snow specimen. The data obtained were transformed into pressure-volume equations of state by applying the Rankine-Hugoniot conservation equations. Author (TAB)

N70-10955# Army Foreign Science and Technology Center, Washington, D.C.

MATHEMATICAL FUNDAMENTALS OF AERIAL PHOTO-INTERPRETATION OF FORESTS [MATEMATICHESKIE OSNOVY DESHIFRIROVANIYA AEROSNIMKOV LESA]

M. K. Bocharov and G. G. Samoilovich 27 Jun. 1969 275 p refs Transl. into ENGLISH from the Russian
(AD-691916; FSTC-HT-23-733-68) Avail: CFSTI CSCL 2/6

The present status of photo-interpretation of forests is discussed along with results of theoretical and experimental studies on use of mathematical modeling in investigating tree stands. The use of computers in forest management is feasible and requires starting information and the preparation of special maps bearing information essential for electronic computer operation. Mathematical modeling expands the theory of timber stand study and leads to new methods of measurement and determination of appraisal indexes concerning timber stands. Author (TAB)

N70-10976# Geological Survey, Washington, D.C.

GEOLOGIC ANALYSIS OF A MULTISPECTRALLY PROCESSED APOLLO SPACE PHOTOGRAPH

William D. Carter and Richard F. Meyer (Office of Oil and Gas) 1968 7 p refs
Avail: Issuing Activity

One Apollo photograph of the Carlsbad–Hobbs area in New Mexico was selected for experimental processing because of its apparently subdued topography and simple geologic structure. A two inch return beam, high resolution vidicon camera, colored glass filters, and a laser image reproducer were used to scan the photograph and to produce three dye transfer images representing the red, green, and blue parts of the visible spectrum. The green dye transfer print conveyed the most information. Geologic, vegetative, and cultural features were classified on the basis of their relative reflectance or degree of brightness. The most significant geologic feature seen in the green dye transfer print is a major northeast trending lineament. The lineament is believed to correspond to a structural depression or channel in the Precambrian basement that projects northeastward from the Delaware basin. The lineament may represent a zone of weakness that was active periodically throughout geologic time and along which coral reefs developed in Permian time. Author

N70-10986# Army Foreign Science and Technology Center, Washington, D.C.

USE OF AERIAL METHODS FOR THE STUDY OF TUNDRA LANDSCAPES AND FOR THEIR AGRICULTURAL UTILIZATION

V. N. Andreev 1969 9 p Transl. into ENGLISH from a Russian Article
(AD-691972; FSTC-HT-23-284-68) Avail: CFSTI CSCL 2/3

Aerial methods make possible the study of individual types of the microrelief of the tundra landscapes and the establishment of correlations of the soil - vegetation groupings. The results are of practical importance for agriculture. Author (TAB)

N70-11005# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIMENTAL INVESTIGATIONS OF CONVECTIVE MOVEMENTS IN THE BOUNDARY LAYER OF THE ATMOSPHERE

D. A. Konovalov 29 May 1969 23 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 205, 1967 p 153–163
(AD-692156; FTD-MT-24-03-69) Avail: CFSTI CSCL 4/2

A method for investigating mesoscale convection in the boundary layer of the atmosphere is described which involves the use of an instrumented aircraft and glider to determine simultaneously the ascending air current and provide information on the horizontal and vertical extensions of a current, its structure, the temperature and humidity within and outside the current, and other characteristics. A group of non-instrumented gliders circling in the air marks the ascending currents and aids in determining the center of the current and the boundaries of its extension. The velocity of ascending currents is measured by a glider by determining the vertical velocity of the glider relative to the earth by means of a variometer and the vertical velocity of descent of the glider relative to the air in an undisturbed atmosphere. Author (TAB)

N70-11024# Army Foreign Science and Technology Center, Washington, D.C.

USE OF THE PROPERTIES OF THE SOIL COVER IN THE INTERPRETATION OF GROUND WATER ON AERIAL PHOTOGRAPHS

V. V. Kuznetsov 1969 26 p refs Transl. into ENGLISH from Aka. Nauk SSSR, Lab. Aerometodov Primenenie Aerometodov Dlia Azsuheniia Gruntovykh Vod (Moscow), 1962 p 80–89
(AD-692627; FSTC-HT-23-393-68) Avail: CFSTI CSCL 8/8

A study was made of the relationships between the soil cover and ground water using aerial photographs taken in different landscape areas in the Northern Caspian Lowland and Turkemenia. The work was done in key areas together with geobotanical, geomorphological and hydrological studies. It was found that a study of the soil cover (thickness of genetic horizons, color, moisture content, humus content, content of salts, etc., as well as the characteristics of the structure and mechanical composition of the -soils) gives information on the character and depth of ground water. Soils beneath which fresh ground water is situated close to the surface appear on aerial photographs in dark tones. Author (TAB)

N70-11038# Michigan Univ., Ann Arbor. Inst. of Science and Technology.

APPLICATIONS OF COHERENT OPTICS TO GEOLOGICAL IMAGERY

R. H. Mitchel and F. B. Rotz Aug. 1969 58 p refs
(Contract F19628-67-C-0402)
(AD-691267; SR-1; AFCRL-69-0135) Avail: CFSTI CSCL 8/7

This report describes some applications of coherent optics to geological imagery. Three problems are discussed: (1) the determination of the two-dimensional power spectrum of water waves, (2) the detection of linear geological features in aerial photographs, and (3) water motion detection and measurement. Experimental results as well as analytical discussions are included. Author (TAB)

N70-11060# International Training Centre for Aerial Survey, Delft (Netherlands).

METHODICAL APPROACH TO INTERPRETATION OF SPACECRAFT PHOTOGRAPHY OF HUMID AREAS

V. M. Dehai Kulkarni (K. J. Somaiya Coll. Bombay) Mar. 1969 7 p Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14–25 Jul. 1969
Avail: CFSTI

The Gemini photograph No. Nasa-S-66-54676 of peninsular India shows a distinct relationship existing between cloudiness and altitude. This is demonstrated by using line sampling techniques. In the comparatively cloudfree areas below 300 metres altitude, direct interpretation of the spacecraft photo is possible as exemplified by the Cauvery Delta. In the higher parts of the subcontinent, only indirect interpretation is possible based upon cloud percentage, patterns etc. Some examples are given of this approach.
Author (ESRO)

N70-11065*# General Electric Co., Schenectady, N.Y. General Physics Lab.
RADIATION EFFECTS Final Report, 31 Aug. 1968 – 31 Jul. 1969
R. L. Fleischer, P. B. Price, H. R. Hart, Jr., and R. T. Woods 11 Sep. 1969 67 p refs
(Contract NAS9-7898)
(NASA-CR-101979; SC-33-045-(028)) Avail: CFSTI CSCL 08G

Work is summarized which is directed at preparation for examination of lunar samples for stored particle tracks of whatever types may be present, whether from internal or external origin. The particle track work falls into six categories: (1) examination and fission track dating of terrestrial impact produced materials; (2) examination and identification of tracks in extraterrestrial materials; (3) improvement in techniques for identification of individual particles in minerals; (4) a search for heretofore unidentified natural tracks; (5) accelerator simulation of cosmic ray effects in likely lunar mineral types; and (6) study of the effects of heating and of shock on tracks in minerals.
Author

N70-11066*# General Electric Co., Schenectady, N.Y. General Physics Lab.
AGE OF THE MANICOUAGAN AND CLEARWATER LAKES CRATERS
R. L. Fleischer, J. R. M. Viertl, and P. B. Price *In its* Radiation Effects 11 Sep. 1969 9 p refs (See N70-11065 01-13)
Avail: CFSTI CSCL 08G

Track dating of Manicouagan Crater glass gives 208 (plus or minus 25) m.y. Partial track fading in a Clearwater Lakes sample yields results consistent with the K–Ar age: 290 (plus or minus 30) m.y. The Clearwater Lakes Craters are, therefore, not contemporaneous with any known tektite fall. Track annealing studies are important to the determination of reliable fission track ages.
Author

N70-11067*# General Electric Co., Schenectady, N.Y. General Physics Lab.
AGES OF DARWIN GLASS, MACEDON GLASS, AND FAR EASTERN TEKTITES
R. L. Fleischer, P. B. Price, J. R. M. and R. T. Woods *In its* Radiation Effects 11 Sep. 1969 8 p refs (See N70-11065 01-13)
Avail: CFSTI CSCL 08G

A group of possibly related glasses from the Far East, including seven samples of Darwin glass and the two known samples of Macedon glass, have been dated by the fission track technique. With the exception of a lower age for one Darwin glass sample and one Muong Nong tektite all ages are indistinguishable, suggesting that the Darwin and Macedon impact glasses are related to the Far Eastern tektites.
Author

N70-11068*# General Electric Co., Schenectady, N.Y. General Physics Lab.
A SECOND TEKTITE FALL IN AUSTRALIA
R. L. Fleischer, P. B. Price, and R. T. Woods *In its* Radiation Effects 11 Sep. 1969 4 p refs (See N70-11065 01-13)
Avail: CFSTI

Tektites of a chemical subgroup found in Australia (Chapman's high sodium tektites) have fission track ages of approximately 4 m.y. and hence are part of a distinct tektite fall, one that preceded the formation of the well-known Australasian strewn field 0.7 m.y. ago.
Author

N70-11069*# General Electric Co., Schenectady, N.Y. General Physics Lab.
SCHENECTADY METEORITE
R. L. Fleischer, P. B. Price, R. T. Woods, Eric Lifshin, R. W. Carter (Schenectady Museum, N.Y.) et al *In its* Radiation Effects 11 Sep. 1969 6 p refs (See N70-11065 01-13)
Avail: CFSTI CSCL 08G

The fourth meteorite recovery in the United States during the past decade (and only the second since 1961) occurred on 14 April 1968, in Glenville, New York (a suburb of Schenectady). The exterior of the single stone of mass 283.3 g consists primarily of a dull, black fusion crust, plus a fracture surface that was apparently produced by breakup in the atmosphere. Measurements of the densities of cosmic ray tracks in olivine and pyroxene crystals at four positions in the meteorite, together with our measured cosmic ray exposure time of 31 million years, are evidence that the specimen came from a depth between 4 and 9 cm in a preatmospheric body of greater than 20 cm radius. The U–He-4 and the K–Ar-40 ages, 4.1 times 10 to the 9th power and 4.35 times 10 to the 9th power years, respectively, indicate that the meteorite underwent very little heating in space.
Author

N70-11080# Bochum Univ. (West Germany).
THE SIGNIFICANCE OF ZODIACAL LIGHT MEASUREMENTS BY DEEP SPACE PROBES
R. H. Giese Paris ESRO Dec. 1968 25 p refs
(ESRO-SN-41) Avail: CFSTI

Earth-based observations of zodiacal light can be approximated by different models of the interplanetary dust composition (dielectric and metallic particles, size distribution, number distribution). By use of three models, which all approximate the zodiacal light measurements of Weinberg (1963) and Smith, Roach and Owen (1965), predictions are made for the expected intensity and polarization observable in the ecliptic plane by a space probe at distances of 0.38 and 5.2 astronomical units from the sun. It is shown, that observable differences between the models may be expected, especially in polarization. Furthermore, predictions of particle counting rates and intensities of zodiacal light observable from space probes in and out of the ecliptic plane are presented on the base of simplified models for a wide range of parameters.
Author (ESRO)

N70-11081# Groupe de Recherches Ionosphériques, Issy-les-Moulineaux (France).
THE EFFECT OF COLLISIONS AND MOVEMENT ON THE TRANSFER IMPEDANCE OF A QUADRUPOLE PROBE NEAR THE LOWER HYBRID RESONANCE (LHR) IN THE IONOSPHERE
C. Beghin and C. Renard 26 Mar. 1968 40 p refs
(Contract CNES-67-261)
(GRI-NTP-33) Avail: CFSTI

The behaviour of a quadrupole in the ionosphere, near the lower hybrid resonance (LHR) is studied. Starting from the quasi-electrostatic hypothesis the basic equations are considered which give the potential near a point source of current in a cold, homogeneous, anisotropic and dissipative plasma. The probe is stationary in relation to the plasma and the effect of collisions on the modulus and the phase of the transfer impedance near the LHR frequency is shown. The results of the calculation of the modules of the impedance as a function of altitude in the diurnal ionosphere are given and then the effects of collisions of various

types on the amplitude and phase of the impedance at a given altitude are analyzed. The influence of the movement of the quadrupole probe parallel or perpendicular to the geomagnetic field is studied. As a result of the velocity of the probe a pronounced damping of the resonance is observed in the case where the system is moving perpendicularly to the axis of anisotropy of the medium. A numerical calculation illustrated this effect and allows our one to check the velocity of the approximate calculations, the detail of which is given in the appendices. ESRO

N70-11098# Geological Survey, Washington, D.C.
ATLAS OF ASIA AND EASTERN EUROPE TO SUPPORT DETECTION OF UNDERGROUND NUCLEAR TESTING. VOLUME 5: RUST AND MANTLE CONDITIONS
R. G. Rodriguez Feb. 1969 107 p refs
(AD-692389) Avail: CFSTI CSCL 8/7

The purpose of Volume V is to present a scheme for the crustal structure of Asia and Eastern Europe compatible with the results of published deep seismic-refraction studies and with geologic and physiographic information found in Volume I and Volume II of this atlas. The possibility of constructing a map of crustal thickness based entirely on information obtained through seismic sounding is precluded by the vastness of the area under consideration. Despite an ambitious program of deep seismic sounding undertaken by Soviet scientists in recent years, most of the U.S.S.R. and virtually all of China remain uninvestigated. In order to approximate the structure of the crust in these areas, it has been necessary to correlate the results of seismic studies with the geology and tectonics of a region and extend the information gleaned from recorded profiles into areas where no seismic control is available. Author (TAB)

N70-11114# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
GRAVITY ANOMALIES AND DEEP-SEATED TECTONICS OF THE SOUTHERN URALS [ANOMALII SILY TYAZHESTI I GLUBINNAYA TEKTONIKA YUZHNOGO URALA]
V. I. Arkhipov et al May 1969 17 p refs Transl. into ENGLISH from Glubinnoye Stroyeniye Urala (Moscow), 1968 p 94–100
(AD-692094; ACIC-TC-1527) Avail: CFSTI CSCL 8/7

For the purpose of studying the structure of the earth's crust, an analysis of the data of gravimetric surveys and results of deep seismic sounding was conducted in the southern Urals and adjoining regions. Using this analysis and results, the regional components from the observed field were isolated by means of the Tikhonov-Bulanzhe method. This paper discusses the conclusions reached after analyzing geological and geophysical data presented. Author

N70-11123# Army Foreign Science and Technology Center, Washington, D.C.
UTILIZATION OF THE RESULTS OF GEOBOTANICAL INTERPRETATIONS OF AERIAL PHOTOGRAPHS IN LANDSCAPE INVESTIGATIONS OF THE NORTHERN CASPIAN SEA REGION
A. M. Shvyryaeva 30 Jun. 1969 41 p refs Transl. into ENGLISH from Russian Publ.
(AD-691973; FSTC-HT-23-415-68) Avail: CFSTI CSCL 8/8

The report describes the application of the geobotanical interpretation of aerial photographs of the regions to the north of the Caspian Sea to the determination of the geological landscape of this area. The plant associations growing under specific conditions delineate distinctly the location of various soils and hydrological conditions and hence, the geological origin, age, and topography. Author (TAB)

N70-11184# Osservatorio Geofisico Sperimentale, Trieste (Italy).
PROBLEMS OF TRACING IN HYDROLOGY [PROBLEMI DI TRACCIAMENTO IN IDROLOGIA]
Ferruccio Mosetti Repr. from L'Acqua (Italy), no. 4, Jun.–Aug. 1968 p 3–9 refs In ITALIAN; ENGLISH summary *Its* Contr. No. 183
Avail: CFSTI

The method of artificial tracing of the waters is discussed in both theory and application. The results represent a synthesis of experiments made with radioactive isotopes as well as with other substances. The methodology of the different applications of impulsive and periodic injections are explained. The impulsive injections enable the determination of the direction of the waters, their quantity, and the interchanges, if any, in the same water body (be it a surface or an underground one). The periodic injection can discriminate between directions, although a single tracer is used. An injection of a periodic type (or of the type which can be reduced to a periodic one by a suitable choice of mathematical schemes) is represented by rain driven tracers. From the different concentrations of a natural tracer depending upon the rainfall periodicities over different areas, it is possible to infer the concentration periodicities in a water body fed by the areas above. The knowledge of a periodical behavior and of the ratios between different amplitudes allows the estimation of the direction of the source and the relative part played by the single feeding areas. Author

N70-11187# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
SOME PROBLEMS OF ADJUSTMENT AND ACCURACY EVALUATION OF THE FUNDAMENTAL GEODETIC NETS OF THE USSR [NOKOTORYYE VOPROSY URAVIVANIYA I OSTENSKI TOCHNOSTI OSNOVNYKH GEODEZICHESKIKH SETEY SSSR]
P. A. Gaydayev Aug. 1969 22 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Geod. i Aerofotsemka (Moscow), no. 5, 1967 p 81–92
(AD-692097; ACIC-TC-1539) Avail: CFSTI CSCL 8/5

The construction of the state geodetic nets of the USSR is based on the principle of transition from the general to the particular. In accordance with this principle, the nets are constructed in succession, starting from the first-order ones and only then passing to the lower orders. At the same time it is assumed that any higher-order net has errors which can be disregarded for the construction of lower-order nets. In the article, first and second order planimetric geodetic nets are discussed. TAB

N70-11194# Ludwig-Maximilians-Universität, Munich (West Germany). Meteorologisches Inst.
RESEARCH IN ATMOSPHERIC RADIATION AND SPACE SCIENCE AT THE METEOROLOGICAL INSTITUTE OF THE LUDWIG-MAXIMILIAN'S UNIVERSITY, MUNICH Annual Report 1968 [BERICHT UEBER DIE ARBEITEN DES METEOROLOGISCHEN INSTITUTES DER LUDWIG-MAXIMILIAN'S UNIVERSITY, MUNICH, 1968 [BERICHT UEBER DIE ARBEITEN DES METEOROLOGISCHEN INSTITUTES DER LUDWIG-MAXIMILIANS-UNIVERSITAT MUENCHEN AUF DEN GEBIETEN ATMOSPHAERISCHE STRAHLUNG UND WELTRAUMFORSCHUNG 1968]
H.-J. Bolle and H. Quenzel Jun. 1969 64 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.
(BMWF-FB-W-69-22) Avail: CFSTI

A survey is given of the work in the fields of atmospheric radiation and space research performed by teams of the Meteorological Institute of the University of Munich during 1968. Author (ESRO)

N70-11212# Institut Royal Météorologique de Belgique, Brussels.
IONOSPHERIC AND COSMIC RAY OBSERVATIONS Monthly Bulletin, Jun. 1969 [OBSERVATIONS IONOSPHERIQUES ET DU RAYONNEMENT COSMIQUE Bulletin Mensuel, Juin 1969]
1969 28 p In FRENCH and DUTCH
Avail: CFSTI

Ionospheric and cosmic ray data derived from observations made at Dourbes (Belgium) in June 1969 are tabulated. ESRO

N70-11220# Army Foreign Science and Technology Center, Washington, D.C.
SWAMP VEGETATION: AN INDICATOR FOR NON-FROZEN AREAS IN THE NORTHERN TAIGA OF WESTERN SIBERIA
A. P. Tyrmikov 9 Aug. 1969 15 p refs Transl. into ENGLISH from Akad. Nauk. (USSR), 1963 p 62–71
(AD-692523; FSTC-HT-23-741-68) Avail: CFSTI CSCL 8/6

In the northern taiga of Western Siberia, swamp vegetation can be used to determine the location of frozen and non-frozen areas. The type of vegetation is determined by: (1) the presence or absence of water on the surface of swamps, (2) the presence or absence of a permanently-frozen layer of soil. Surface water in the swamps is a critical factor in thaw, freeze, and temperature of the soil. A number of factors cause variations in the depth and time of thawing and freezing, keeping the swamps in a state of change. The surface levels of the swamps change, causing variation in the amount of surface water, the depth of thaw and freeze, and finally the vegetation. Author (TAB)

N70-11240*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF ATMOSPHERIC OZONE USING THE 9.6 MICRON REGION
C. Prabhakara Sep. 1969 32 p refs
(NASA-TM-X-63733; X-622-69-467) Avail: CFSTI CSCL 04A

Spectral measurements made by a high resolution Infrared Interferometer Spectrometer (IRIS), aboard the Nimbus 3 satellite are used to deduce, remotely, the atmospheric ozone. This indirect method depends on the emission and absorption properties of ozone in the 9.6 micron region, as well as some gross climatological properties of the vertical ozone profile. Several IRIS spectra have been analyzed and the corresponding vertical ozone distributions are determined. Some ozone soundings made by chemical sounders are compared with those derived by the indirect method. The derived profiles can reproduce the gross features of the observed distribution. The total ozone estimated from the derived profiles compares well with the measured total. The atmospheric total ozone can be determined, with the help of IRIS spectra, over a large part of the globe with an accuracy of better than 10 per cent. Author

N70-11246# Oregon State Univ., Corvallis. Dept. of Oceanography.
RESEARCH ACTIVITIES Progress Report, 1 Oct. 1968–31 Mar. 1969
Beverly Knapp Jun. 1969 99 p refs
(Contracts Nonr-1286(10); AF 49(638)-1403)
(AD-692418; PR-23) Avail: CFSTI CSCL 8/1

Contents: Physical oceanography; Geological oceanography; Geophysical oceanography; Chemical oceanography; Radiochemistry and Radioecology; and Biological oceanography. TAB

N70-11263# Air Force Cambridge Research Labs., Bedford, Mass.
SATELLITE OBSERVATION OF EFFUSIVE VOLCANISM
Richard S. Williams and Jules D. Friedman (US Geol. Survey) [1969] 15 p refs Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge Engl., 14–25 Jul. 1969 Prepared jointly with US Geol. Survey
Avail: CFSTI

Effusive volcanic eruptions may be observed and monitored by an 'earth observation satellite'. Instrumentation similar to the Nimbus II HRIR system, which has low spatial resolution/high thermal sensitivity and measures radiation in the 3.45 to 4.02 micron atmospheric window, can be used to survey effusive volcanic events from orbital altitudes. Infrared emission from an active effusive volcanic eruption on Surtsey, Vestmanneeyjar, Iceland, was recorded by airborne and satellite infrared systems at irregular intervals between 19 August and 3 October 1966. Ground and lava temperature measurements and volumetric lava outflow data permitted a comparison to be made between total thermal energy yield and radiant emission recorded by the satellite system. The Nimbus HRIR recorded radiant emission at a level of about 4% of the estimated total thermal yield. Author (ESRO)

N70-11266# New York Univ., N.Y. Geophysical Sciences Lab.
A STUDY OF TEMPERATURE AND SALINITY CHANGES ALONG THE NORTHERN NEW JERSEY COAST Scientific Report
Thomas E. Pease Jul. 1969 60 p refs
(Contract Nonr-285(57))
(AD-692515; GSL-TR-69-7) Avail: CFSTI CSCL 8/10

A brief description of literature pertinent to the oceanography of New York Bight includes a review of the seasonal thermohaline cycle. Estimates are made of significant processes of thermohaline changes. The importance of horizontal and vertical motions leads to a model of the changes based on observed wind-drift in the New Jersey area. The model is compared with infrared temperature surveys, lightship data, and temperature-salinity sections in the coastal zone. Agreement between the model and observations is apparent. Author (TAB)

N70-11271# Meteorological Office (Gt. Brit.)
THE MEASUREMENT OF OZONE FROM A SATELLITE
D. E. Miller 1969 5 p refs Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14–25 Jul. 1969
Avail: CFSTI

Two satellite techniques based on the attenuation of solar ultraviolet radiation have been used to determine the vertical distribution of the atmospheric ozone. In the direct beam method the variation of the intensity of the solar radiation is measured as the satellite moves into the earth's shadow and the rays penetrate tangentially into successively lower levels in the atmosphere. The scattered light method depends on measurements of the intensities of sunlight scattered back up to the satellite at a number of wavelengths in the ozone band. The two methods are compared and it is concluded from earlier experiments that an accuracy of 5% is required before any useful advance can be made. ESRO

N70-11350# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
THE NATURE OF THE MOHOROVICIC DISCONTINUITY [MO-HO CHIEH-MIEN TI HSING-CHIH]
Jung-Sheng Tseng Jul. 1969 20 p refs Transl. into ENGLISH from Ti Ch'iu Wu Li Hsueh Pao (Peking), v. 13, no. 2, Jun. 1964 p 180–188
(AD-692100; ACIC-TC-1574) Avail: CFSTI CSCL 8/7

The paper discusses the various theories on the nature of the Mohorovicic discontinuity and the difficulties encountered by the phase-change hypothesis. By examining the velocity distribution data recently obtained by use of seismic body and surface waves, the following conclusions can be made: (1) The Mohorovicic discontinuity, either under the continents or the oceans, cannot be interpreted as a surface of phase transition. (2) The chemical composition of the upper mantle is not homogeneous in the vertical direction. The low-velocity layer in the upper mantle is probably caused by a change in composition rather than by the temperature effects. (3) The top surface of the asthenospheric low-velocity layer

is deeper under the oceans than under the continents. (4) The chemical composition of the upper mantle, according to the data of radioactive measurements, may be some mixtures of eclogites or other ultra-basic rocks, their change of velocity due to temperature effects being very small. Author (TAB)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N70-10057# Illinois Univ., Urbana. Photogrammetric and Geodetic Engineering Group.
ANALYTICAL AEROTRIANGULATION FOR HIGHWAY LOCATION AND DESIGN Interim Report
H. M. Karara and G. W. Marks Oct. 1968 29 p refs Prepared in cooperation with Ill. State Div. of Highways and Bureau of Public Roads, Washington, D.C.
(PB-183706) Avail: CFSTI CSCL 13B

A comparison of three methods of analytically bridging ground control was made using both ficticious and real data. A 32-photograph flight strip was used in each case. The three methods compared were: (1) two photo, (2) triplet, and (3) block. The triplet method was selected for use in future work. USGRDR

N70-10144# United Nuclear Corp., Elmsford, N.Y. Research and Engineering Center.
A CONTINUOUS ELECTROCHEMICAL METER FOR MEASUREMENT OF HYDROGEN IN SODIUM Progress Report, 1 Jul. – 30 Sep. 1968
N. Fuhrman, W. Caplinger, G. Lubitch, R. B. Holden, L. Liggett et al 31 Oct. 1968 29 p refs
(Contract AT(30-1-3908)
(UNC-5232) Avail: CFSTI

Ten experimental electrochemical hydrogen sensors were tested in hydrogen – argon mixtures at several hydrogen levels ranging down to concentrations equivalent to below 1 ppM hydrogen in sodium. In general, sensors operating with gas reference electrodes and electrolytes consisting of ionic hydrides dissolved in LiCl – KCl eutectic responded to hydrogen changes in accordance with a hydride ion transport concentration cell model. The departure of voltage response from theoretical, however, increased as the hydrogen level decreased. The testing of sensors in a sodium loop was initiated. Author (NSA)

N70-10146# Hulburt (E. O.) Center for Space Research, Washington, D.C. Space Science Div.
RADIATION SOURCES FOR STELLAR TELESCOPE CALIBRATION FROM 700 ANGSTROMS TO 7000 ANGSTROMS
W. R. Hunter *In* NRL Rept. of NRL Progr., Sep. 1969 p 1 – 9 refs Presented at the Workshop on Opt. Telescope Technol., Marshall Space Flight Center, Alabama, 29 Apr. – 1 May 1969 (See N70-10145 01-34)
Avail: CFSTI

A number of sources are available that can furnish radiation for calibrating instruments in the wavelength region 700 to 7000 angstroms. The synchrotron is useful over this entire spectral range and requires no standardization. Electrical discharges in gases can be used for the vacuum ultraviolet and tungsten ribbon lamps and the carbon arc for the near ultraviolet, visible, and near infrared. However, because of the difficulty in standardizing these sources, especially vacuum ultraviolet sources, they will require frequent calibration against a known source. Author

N70-10154# California Inst. of Tech., Pasadena.
SUPPORT OF BASIC RESEARCH INTO INVESTIGATIONS INTO IMPROVEMENT OF ASTRONOMICAL PHOTOGRAPHY Final Report
Bruce C. Murray and James A. Westphal Apr. 1969 16 p
(Contract NSF GP-5113)
(PB-184058) Avail: CFSTI CSCL 03A

The paper is the final report of a grant to explore various approaches to the improvement of astronomical photography, especially the use of post-detection processing (spacial filtering). In it, four experiments are illustrated for the benefit of other workers in the field and some preliminary conclusions are stated. USGRDR

N70-10233# Rocket Propulsion Establishment, Westcott (England).
A CONICAL PROBE FOR SAMPLING IONS FROM HIGH TEMPERATURE GASES
R. C. Golesworthy and D. R. B. Ripp Dec. 1968 8 p refs
(AD-692057; TM-488) Avail: CFSTI CSCL 14/2

A method of fabrication is described whereby a sampling orifice of about 0.1 mm diameter may be produced in a noble metal insert carried at the apex of a hollow stainless steel conical probe. The method permits the orifice to be formed in metals having desirable chemical and thermal properties but which are otherwise difficult to machine or prohibitively expensive for use as the bulk material of the probe. Author (TAB)

N70-10236# Harry Diamond Labs., Washington, D.C.
SHOCK TUBE TECHNIQUES AND INSTRUMENTATION
Harry J. Davis and Herbert D. Curchack Mar. 1969 46 p refs
(AD-692295; HDL-TR-1429) Avail: CFSTI CSCL 14/2

A survey of shock-tube techniques and instrumentation is presented. Ideal shock tube theory is outlined as are various phenomena which influence actual performance. Shock tubes designed for specific purposes are described. Shock tube instrumentation is discussed in terms of the variable to be measured. Author (TAB)

N70-10260# Panametrics, Inc., Waltham, Mass.
DESIGN AND DEVELOPMENT OF AN ISOTOPIC ALTIMETER SETTING INDICATOR, VOLUME 1 Final Report
B. Sellers and P. Morse Jun. 1969 90 p refs
(Contract FA-67-WA-1659)
(FAA-RD-69-38-Vol-1) Avail: CFSTI

Design and development of an altimeter setting indicator system based on use of a radioactive alpha particle emitter as the primary sensing mechanism is described. Because the isotope measures density, a controlled temperature enclosure is utilized to provide an output proportional to pressure. The system uses a computer controlled closed loop servo to maintain the source at the constant range position with respect to the detector. A shaft encoder maintains continuous knowledge of the actual source detector distance, by which the pressure is deduced from a calibration curve. The altimeter setting indicator is calculated by the computer and displayed digitally. In its present form the system does not meet the design objective accuracy of + or – 0.005 inches of mercury. It is believed, however, that when temperature instabilities are corrected this objective will be achieved. Author

N70-10261# Panametrics, Inc., Waltham, Mass.
DESIGN AND DEVELOPMENT OF AN ISOTOPIC ALTIMETER SETTING INDICATOR, VOLUME 2: APPENDIXES Final Report

B. Sellers and P. Morel Jun. 1969 88 p
(Contract FA-67-WA-1659)
(FAA-RD-69-38-Vol-2) Avail: CFSTI
For abstract see N69-10260.

N70-10283# Gulton Industries, Inc., Albuquerque, N. Mex. CG Electronics Div.
INSTRUCTION MANUAL: SATELLITE INFRARED ON-BOARD SEQUENCER
1968 26 p
(PB-184180) Avail: CFSTI CSCL 20F

The SOBS accepts an externally furnished input signal which is fed to a counter. The output of this counter is applied to a second counter. The outputs of the F/F's are matrixed to provide specified waveforms on six output channels. The acceptance of a mode change pulse changes the mode of operation and clears the second counter thus assuring a sequence initiation in less than 64 seconds. Author (USGRDR)

N70-10334# Naval Research Lab., Washington, D.C. Applications Research Div.
THE DESIGN OF AN INEXPENSIVE MULTI-CHANNEL PROGRAMMED RECORDER
A. W. Baldwin and Clarence Carson Jul. 1969 12 p
(AD-692386; NRL MR-2021) Avail: CFSTI CSCL 14/3

A requirement for a low-cost two channel recorder (under $500.00) has been met in the design of a Polaroid-camera-oscilloscope combination programmed for a six-second record shot. The particular signals recorded are five channels of analog (voltage levels) information which has been sequence commutated prior to recording. The above signals had been previously recorded using a two-channel pen recorder and associated event markers. Author (TAB)

N70-10344# Illinois Univ., Urbana. Dept. of Civil Engineering.
METHODS OF GRAPHICAL AND ANALYTICAL MENSURATION OF SINGLE TERRESTRIAL PHOTOGRAPHS
J. M. Fry (M.S. Thesis) May 1969 191 p refs *Its* Photogrammetry Ser. No. 23
(PB-183889) Avail: CFSTI CSCL 08B

In the field of photogrammetry considerable effort has been expended in the development of mensuration techniques for both aerial and terrestrial photography. Mensuration on a single frame of photography falls outside the realm of stereophotogrammetry and requires a somewhat different approach. Indeed, dimensional information may be needed of a particular subject imaged only on one photograph – a photograph in which the type of camera, format size, focal length, camera position and camera orientation are all unknown. Even under such adverse conditions it may be possible to provide reliable information if the geometry of the photograph can adequately be reconstructed. The fundamental concepts of photogrammetry and perspective geometry will serve as a basis for the graphical and analytical mensuration techniques applicable to a single photograph. Author (USGRDR)

N70-10389*# Techtran Corp., Glen Burnie, Md.
HOLOGRAPHY AND CINE-HOLOGRAPHY OF RAPIDLY OCCURRING PROCESSES
A. N. Zaidel (USSR Acad. of Sci.) et al Washington, D.C. NASA Oct. 1969 10 p Transl. into ENGLISH from High-Speed Phot.: Proc. of the 8th Intern. Congr. (Stockholm), 23–29 Jun. 1968 p 309–313
(Contract NASw-1695)
(NASA-TT-F-12641) Avail: CFSTI CSCL 14E

Description of an apparatus for cineholographic treatment of rapidly occurring processes. Consisting of a ruby laser and a semitransparent mirror, it contains no moving parts and can produce photographs within 10 to 100 nsec intervals. Some interferometric data thus obtained are discussed, and a holographic interference study of pulse discharges made by a framing camera is reported. Author

N70-10473# National Academy of Sciences-National Research Council, Washington, D.C.
NONDESTRUCTIVE EVALUATION Final Report, 1967–1969
Jun. 1969 161 refs
(Contract DA-49-083-OSA-3131)
(AD-692491; NMAB-252) Avail: CFSTI CSCL 14/2

Nondestructive evaluation (NDE) must be incorporated into every phase of the design-production-service cycle, including the screening and qualification of materials for new design criteria, in order to design materials to their limits to satisfy the ever-increasing demands of sophisticated military systems. Even in the presence of adequate technology, the key to NDE implementation and maximum hardware reliability is the proper application of suitable specifications. Solving NDE problems requires selecting test parameters, designing tooling, defining acceptance levels and using more than one technique for evaluation. Automatic data processing equipment must be used to attain quantitative capabilities through rapid feedback of data for process control, utilization of all data, comparison with prior data for early detection of trends and to evaluate operational changes. Among areas recommended for further study were failure mechanism, data processing, lasers, holography, acoustic propagation, and acoustic emission. A greater number of NDE professionals and technicians is needed and could be produced through increased university and other technical training. The establishment of national NDE research and application centers was recommended. Author (TAB)

N70-10483*# General Electric Co., Utica, N.Y.
EQUIPMENT SPECIFICATION FOR A SPACE RATED RADAR ALTIMETER Final Technical Report
T. W. Godbey, B. N. Keeney, W. J. Kelly, F. H. Klauser, L. A. Mc Laren et al Jan. 1969 119 p refs
(Contract NAS12-683)
(NASA-CR-86251) Avail: CFSTI CSCL 14B

This report presents three equipment specifications which describe the capabilities of altimeters suitable for the Geos C mission. The fact that three designs were synthesized to meet the mission requirements emphasizes the conclusion that the construction of an altimeter suitable for orbital use over ocean is feasible. Calculations presented in the body of this report indicate that an ultimate accuracy on the order of one meter is feasible for altitudes up to 850 nautical miles. In addition useful measurement of sea state can be obtained employing both AGC and sea state gate information in the altimeter receiver. This has been achieved with designs that consume a maximum power of 34 watts, weigh a maximum of 26 pounds, and otherwise meet the restrictions of the Geos C spacecraft. Analysis of the altimeter performance over ocean was greatly enhanced through laboratory tests of receiver circuits using the Sea Return Pulse Simulator, devised during this study. The simulator also served to provide a valuable human insight into the signal detection problem faced by the altimeter. Author

N70-10541 National Lending Library for Science and Technology, Boston Spa (England).
THE USE OF AN ELECTROKINETIC TARGET TO RECEIVE AN ULTRASONIC IMAGE
V. G. Prokhorov 29 Apr. 1969 5 p refs Transl. into ENGLISH from Akust. Zh. (Moscow), v. 14, no. 1, 1968 p 139–141
(NLL-CE-Trans-5109-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

The constructional features of an electronic-acoustic converter with electrokinetic target are shown and its operation investigated on a special test rig. It was found that, thanks to the special characteristics of its capillary structure, small thickness and the possibility of varying the shape of its receiving surface, the electrokinetic target should produce less distortion in the image than the piezo-target. Author

N70-10543# Aeronautical Research Labs., Melbourne (Australia).
THE OPTIMUM DESIGN OF STRAIN GAUGE STING BALANCES FOR WIND TUNNEL MODELS
N. Pollock Mar. 1969 35 p refs
(ARL/A-133) Avail: CFSTI

The relative merits of a number of strain gage sting balance mechanical configurations are compared. The ability to combine a high output strain at the gage stations with a low overall deflection is the main basis for the comparison. Where possible improved designs are suggested. Various force and moment components were considered separately, but general conclusions were: (1) Balance layouts incorporating tension and compression strips combine simplicity with fairly high stiffness. The minimum load for which a balance of this type can be designed is limited by elastic buckling of the compression strip. (2) Balances using eccentrically loaded columns as measuring elements are designed to have extremely high stiffness. (3) Balance designs incorporating beams in bending are simple to manufacture, but they have inferior performance characteristics to designs using tension and compression strips or eccentrically loaded columns. (4) The strain gages used should have the smallest length and width possible because the maximum stiffness of any balance configuration is a function of the physical dimensions of the gages used. (5) For a given balance configuration and strain output the deflection is independent of the balance material. However, when very small forces are measured the physical dimensions of the balance elements may be so small that they are difficult to manufacture if steel rather than aluminum is used. Author

N70-10551# International Training Centre for Aerial Survey, Delft (Netherlands).
IMAGE FORMATION TECHNIQUES FOR REMOTE SENSING FROM A MOVING PLATFORM
S. A. Hempenius Aug. 1969 36 p refs *Its* Ser. A, No. 46; Ser. B, No. 53
Avail: CFSTI

The geometrical characteristics for seven basic techniques of image formation from a moving platform are compared. Grouped into three categories with respect to the kind of image formation (optical, scanning, and echo–time I.F.) they are presented in a wall chart, together with alternative and hybrid systems and their offspring. Although spectral considerations are basically omitted, the passive and active working modes are discussed and the nonimage formation remote sensing is mentioned. Seven pictures show the relative perspective distortion. Selective image formation and filtering emphasize additional important properties of the unconventional remote sensing techniques. Author

N70-10556# International Training Centre for Aerial Survey, Delft (Netherlands).
KODAK EKTACHROME INFRARED AERO FILM FOR FORESTRY PURPOSES
D. A. Stellingwerf Mar. 1969 14 p refs *Its* Ser. B, No. 54
Avail: CFSTI

The usefulness of Ektachrome infrared aero film for the detection of diseases, damages, mortality and the effect of fertilizers on trees is promising. Especially as diseases with nonvisible crown symptoms can be registered, this film is preferred over full color film for this purpose. For visible crown damage resulting from diseases, defoliators, air pollution or any other source, full color film in many cases gives similar results. For species recognition this type of film is not always superior to other types. Best solution for this purpose seems multiband photography and sequential imagery. Application of 70 mm film cameras opens the possibility to use many film types simultaneously. Author

N70-10562 National Lending Library for Science and Technology, Boston Spa (England).
THE ELECTRON MICROSCOPE AS AN AID IN CORROSION RESEARCH
R. Grauer 18 Jul. 1969 13 p refs Transl. into ENGLISH from Werkstoffe Korrosion (Weinheim), v. 19, no. 10, 1968 p 845–854
(NLL-CE-Trans-5152-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Reviewed are image formation in the electron microscope and electron diffraction with a grazing beam. The study of mechanically separated corrosion products and techniques for producing carbon support foils is discussed. Outlined are methods of studying compact layers of corrosion products and it is shown how such layers can be separated from the metal substrate. Procedures for preparing and stripping single-stage and matrix replicas of surfaces are explained. A review of the limitations of electron-optical methods of investigation is included. Author

N70-10609# Army Foreign Science and Technology Center, Washington, D.C.
LANDSCAPE INVESTIGATIONS OF RESERVOIRS USING AERIAL METHODS
N. N. Sokolov 9 Aug. 1969 19 p Transl. into ENGLISH from Selskokhoziastvenhai Akad., 1964 p 217–224
(AD-692375; FSTC-HT-23-744-68) Avail: CFSTI CSCL 13/2

Reservoirs are man-made features which are in a state of constant change, both seasonally and over a relatively short number of years. Being important economic units, of great concern to a number of branches in the national economy, they must be kept under constant surveillance in order to determine any significant changes. The most effective means for conducting such observations is the use of aerial photographs. The article is devoted to the importance of aerial photographs for this purpose, giving some examples of the type of information which can be read from aerial photographs, and some proposals for the more effective use of aerial photographs in studying the dynamic picture of changes in reservoirs. TAB

N70-10660# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 204 14 May 1969 p 41–57 refs (See N70-10656 01-34)
Avail: CFSTI

The development of cryogenic nuclear precession magnetometers is reported, as well as a newly designed, highly accurate quartz magnetic sensing element. Scientific papers are briefly summarized on such topics as geomagnetic and seismic activity and the origin and nature of the earth planetary structure. A.C.R.

N70-10668# Groupe de Recherches Ionosphériques, Issy-les-Moulineaux (France).
OPERATION AND WORKING PROCEDURES FOR THE FR-1 'ECHOMETRIE' SIGNAL ANALYZER [FONCTIONNEMENT ET EXPLOITATION DE LA CHAINE DE DEPOUILLEMENT FR-1 'ECHOMETRIE']
V. Micic Apr. 1968 32 p In FRENCH
(GRI-NTP-34) Avail: CFSTI

The FR-1 satellite signal analyzer (Echométrie) performs two functions: 1) measurement of the preparation time of VLF waves between two conjugated points; 2) acquisition of a clear display of signal carbons received from the satellite. ESRO

N70-10738# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France).
AUTOMATIC DEVICE FOR MEASURING BETA-EMITTING SOURCES: PAPA BETA-METERS [DISPOSITIF AUTOMATIQUE POUR LA MESURE DE SOURCES EMETTRICES DE RAYONNEMENT BETA: PAPA BETA METRES]
Jean Colomer and Michel Valentin Jun. 1969 33 p refs In FRENCH; ENGLISH summary
(CEA-R-3782) Avail: CFSTI

The apparatus was designed for measuring beta-emitting elements by the absorption method and is suitable for carrying out a large number of routine analyses. A mechanical device pushes an aluminium absorption set automatically between the source and the detector. The movement is programmed for cutting in and out by a transistorized electronic unit. The results are printed out and punched on tape and this can then be mathematically processed by a computer for the tracing of absorption spectra extrapolation and calculation of the activity. The detector is either a beta-probe or a proportional counter with a specially designed loop. For routine measurements, the accuracy obtained with all corrections made, is from 5 to 8 per cent, the reproducibility being about 2 percent. Author (ESRO)

N70-10758# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Flight Dynamics Lab.

SCRATCH STRAIN GAGE EVALUATION Summary Report, Oct. 1968–Jan. 1969

Theodore L. Haglage and Howard A. Wood Jul. 1969 44 p refs

(AD-692480; AFFDL-TR-69-25) Avail: CFSTI CSCL 14/2

The test results on the evaluation of the Prewitt Scratch Strain Gage are presented in the report. The test program was twofold: (1) observation of the gage operation under various strain applications and (2) investigation of strain recording sensitivity and measurement. The scratch strain gage as tests indicated is a feasible and accurate means of recording strains of a character and magnitude expected to be found in a typical aircraft structure. The recording sensitivity is controlled by proper installation techniques and gage length. For the laboratory conditions reported, the measured strains were equivalent to the electrical resistance gages within 100 micro strain. Author (TAB)

N70-10785# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PHOTOELECTRIC MEASURING SYSTEMS MEASUREMENT OF LINEAR AND ANGULAR QUANTITIES

A. V. Mironenko 3 Feb. 1969 285 p refs Transl. into ENGLISH from the Russian

(AD-692496; FTD-HT-23-853-68) Avail: CFSTI CSCL 14/2

Contents: Introduction to the techniques of high-precision photoelectric measurement of linear and angular quantities; Combination pattern elements; Photoelectric measurement systems; Scanning in measurement units; Reading converters; Null-type compensating measurement systems; Photoelectric coded position sensors; Counting superposition and interference bands; Errors of pattern-element units; and Measurement-system errors and certification. TAB

N70-10809# Royal Aircraft Establishment, Farnborough (England).

TECHNIQUES FOR EARTH-POINTING ATTITUDE CONTROL OF A SPACECRAFT

W. G. Hughes and M. B. Barnes 1969 28 p refs Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14–25 Jul. 1969

Avail: CFSTI

This paper surveys the attitude control techniques particularly applicable to earth-pointing spacecraft, covering horizon sensors and overall systems of the spinning, gravity gradient, and fully stabilized varietis. Considerable attention is given to the gyrocompassing technique for spinning and fully stabilized vehicles. Author (ESRO)

N70-10861# Singer-General Precision, Inc., Little Falls, N.J. Kearfott Div.

FLIGHT TEST OF MODEL 302-A MILLIMETER RADIOMETRIC SYSTEM Final Report, Jun. 1968–Dec. 1968

Jun. 1969 89 p

(Contract DAAA-21-67-C-0917)

(AD-691912; B19400244) Avail: CFSTI CSCL 14/2

This report describes the results of the flight test of the Model 302-A Radiometric System. The appendices are comprised of basic concepts, significant equations and various support data which are germane to this report. The primary objective of the program was to demonstrate that a millimeter radiometric system can operate successfully in a flight environment. The flight tested radiometer was a contrast type, centered at 35 ghZ. The platform used for the overflights was a helicopter, flying at speeds up to approximately 90 mph and at altitudes ranging from 100 feet to 700 feet above the targets. Radiometer measurements were correlated in real time with a boresighted TV camera. The corresponding data from the two sensors was transmitted to the ground via a TV link. Targets consisting of light aircraft, trucks and jeeps were overflown. The results revealed that these targets were consistently detected. Some problems were encountered with false alarms due to the random nature of the background. The factor confirms the need for additional development in background discrimination techniques. Author (TAB)

N70-10892 National Lending Library for Science and Technology, Boston Spa (England).

ABSOLUTE MEASUREMENTS OF THE SKY NIGHTGLOW CONTINUOUS SPECTRUM [ABSOLYUTNYE IZMERENIYA NEPRERYVNOGO SPEKTRA SVECHENIYA NOCHNOGO NEBA]

L. M. Gindilis May 1969 14 p refs Transl. into ENGLISH from Rezultaty Issled. v Programe Mezhdunarodogo Geofiz. Goda (USSR), pt. 4, no. 11, 1965 p 26–34

(NLL-RTS-5084) Avail: Natl. Lending Library, Boston Spa, Engl.: 22s 6d

During the International Geophysical Year spectral observations of the night sky glow were carried out by nebular spectrograph near the antisolar point in order to study the nature of gegenschein. Results of the absolute spectrometry in the 4200–6500 A range are given in table form. Intensity of the continuum changed from 0.8 to 1.9 R/A and averaged 1.5 R/A. Energy distribution in the night sky continuous spectrum did not resemble that in the spectra of the Sun and other stars. The shape of the energy distribution curve was determined by the presence of a continuous emission. Diurnal variations of continuum intensity were pointed out. G.G.

N70-10965# Rochester Univ., N.Y. Particle Physics Lab.

DATA ON CERENKOV COUNTERS

A. C. Melissinos and W. J. Stinson 5 Sep. 1968 32 p refs

(Contract AT(30-1)-875)

(UR-875-255) Avail: CFSTI

Data on specifications, assembly, drawings, and operational data are presented on five different Cherenkov detectors. These include 4-inch, 12-inch, and 42-inch low pressure gas threshold detectors, a 5-inch high pressure gas differential detector, and a 4-inch liquid radiator differential detector. NSA

N70-10989# Tennessee Univ., Tullahoma. Space Inst.

FUNDAMENTALS OF HOLOGRAPHIC VELOCIMETRY Final Report, Jun. 1967–Jul. 1968

Frederick M. Shofner, Reinhard Menzel, and Thomas G. Russell Nov. 1968 80 p refs

(Contract F33615-67-C-1846)

(AD-692477; AFFDL-TR-68-140) Avail: CFSTI CSCL 20/4

The purpose of this exploratory research was to establish guidelines for the recording and recovering of three-dimensional velocity information utilizing holographic techniques. The form and resolution of the recorded data were established experimentally and theoretically for both plane and spherical wave illumination. A theory was developed for analyzing the Fraunhofer hologram of a single particle in the spatial frequency domain of an optical data processor. General considerations for both electronic and optical data processing of the flow field data are given. Author (TAB)

N70-11049# Joint Publications Research Service, Washington, D.C.

AN INSTRUMENT FOR STUDYING COSMIC RADIATION AT ALTITUDES OF 200–400 KM

V. L. Maduyev et al. 30 Oct. 1969 6 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. Fiz. i Astron. (Moscow), no. 4, 1969 p 79–82
(JPRS-49167) Avail: CFSTI

The RG-1 radiometer is used to measure distribution of absorbed doses by means of a tissue equivalent ionization chamber, to study the energy spectrum of protons in the energy range of 0.5 to 10 MeV, and to analyze the energy spectrum of electrons in the energy range of 60 to 500 keV. The apparatus consists of two circuits for radiation detection and a circuit for electron measurement. The device was installed on the 'Cosmos-228' satellite and functioned according to the set program. R.B.

N70-11057# Army Material Command, Hanover, N.H. Cold Regions Research and Engineering Lab.
BIAXIAL STRESS AND STRAIN MEASUREMENTS USING PHOTOELASTIC HOLLOW CYLINDER INCLUSION METERS
Ivor Hawkes Jun. 1969 34 p refs
(AD-692289; CRREL-SR-133) Avail: CFSTI CSCL 14/2

It is shown that for a wide range of rock and concrete-like materials a glass stressmeter will enable the stresses to be determined directly without knowledge of the host material modulus The results of tests using frozen sand slabs have shown that under uniaxial stress there is little effect of creep on the meter readings until excessive fracturing occurs. There is also close agreement between the theoretical and experimental values for the meter sensitivity when it is assumed that the Poissons ratio of the host materials falls to 0.5 during creep (no volume change in stressed material during creep). Experiments are also described which show that the stress can be determined in a material which is creeping by inserting a stressmeter and measuring the final steady reading. It is shown that for a low modulus (plastic) inclusion the sensitivity is a function of the ratio of the moduli of the host and gauge materials except when the host material is undergoing continuous creep. The long term sensitivity is then again independent of these factors. Author (TAB)

N70-11102# Defense Documentation Center, Alexandria, Va.
PHOTOGRAPHY, RAPID PHOTOGRAPHIC PROCESSING AND UNDERWATER PHOTOGRAPHY, VOLUME 1 Bibliography, Jan. 1953–Mar. 1969
Aug. 1969 87 p refs
(AD-693000; DDC-TAS-69-52-1) Avail: CFSTI CSCL 14/5

This is volume I of a three-volume bibliography on Photography. It deals with the technique of Underwater Photography and of Rapid Photographic Processing. The collection of 51 citations reflects the methods and materials connected with each subject, and covers articles in the DDC collection from January 1953 to March 1969. Corporate Author/Monitoring Agency, Subject, Personal Author, Contract, Report Number and AD Number Indexes are given. Author (TAB)

N70-11111# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
CRYOSTAT AND STRAIN MEASUREMENT FOR TENSILE TESTS TO 1.5 K
R. P. Reed and R. L. Durcholz 1969 18 p refs
Avail: Issuing Activity

Simple, efficient, tensile cryostat equipment was designed, assembled, and operated at temperatures as low as 1.5K. New capacitance strain-sensing devices were designed, built, and used at these low temperatures that appear to have qualities superior to presently used equipment. Author

N70-11142*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF MASS FLUX PROBE IN A MACH 3 STREAM
Lloyd N. Krause and George E. Glawe Washington Nov. 1969 15 p refs
(NASA-TN-D-5563; E-5110) Avail: CFSTI CSCL 14B

The characteristics of two similar (0.23 cm. diam. inlet) mass flux probes in a Mach 3 gas stream with a nominal Reynolds number per meter of 5×10 to the 8th power are presented. Both probes agreed with the calculated mass flux of the gas stream to within 1 percent. The major source of error in mass flux determination for the probe size used was due to uncertainty in the geometric inlet area. The probe is insensitive to angle of attack up to about 20 deg if the capture area is based on the projected geometric capture area of the probe. When used as a total pressure tube (aspiration off), the probe is insensitive to angle of attack up to about 25 deg. Author

N70-11161# California Univ., Berkeley. Human Factors in Technology Research Group.
A PROPOSED SCALE FOR TIME-SPAN MEASUREMENT
E. R. F. W. Crossman Oct. 1968 9 p refs Revised
(Contract N00014-67-A-0114)
(AD-692179; HFT-68-4-Rev) Avail: CFSTI CSCL 14/2

A case is briefly developed for rationalizing the metric used in Jaquesian level-of-work, responsibility, and time-span capacity determinations. Based on existing data, reasons are given for adopting a base 2 logarithmic scale of organizational time, referred to 1 minute. It is proposed to measure level-of-work, etc., in logarithmic time units (1.t.u.s) rather than in the clock and calendar units currently employed. A brief discussion is given of certain extensions of the time-span concept suggested by 1.t.u. scaling. Author (TAB)

N70-11227*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THICKNESS MEASURING AND INJECTION DEVICE Patent Application
Robert L. Spencer, inventor (to NASA) Filed 30 Jul. 1969 8 p
(NASA-Case-MFS-20261; US-Patent-Appl-SN-845990) Avail: CFSTI CSCL 14B

A device is described for measuring the thickness of a surface material, such as spray-on foam insulation applied on a backing, and injecting a repair substance into the material. An injection gun comprises a needle that penetrates the thickness of the material being measured while a slidable thickness-indicating rod is pushed inwardly of the gun by an amount equal to the penetration of the needle. Two separate syringe cylinders are provided for containing fluid components that form foam insulation material when mixed. As the needle is withdrawn from the foam material these components are injected through separate needle passages into the cavity formed by the needle penetration. NASA

N70-11245*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
A HOLOGRAPHIC IMAGE ENHANCEMENT TECHNIQUE Patent Application
James N. Hallock, inventor (to NASA) Filed 30 Jul. 1969 14 p
(NASA-Case-ERC-10135; US-Patent-Appl-SN-845976) Avail: CFSTI CSCL 14E

A process for forming holograms is described with which the exposure time of the hologram plate to the information being recorded is significantly reduced. The technique first exposes the hologram plate to signal and reference beams as in standard practice, but only for an amount of time sufficient to record the signal just above the fog level of the plate, that time being only a fraction of the total exposure time necessary to form the hologram. The signal beam is then removed, and the plate is then further exposed to either the reference beam, another coherent beam or even incoherent light for the remainder of the much longer time necessary to form a regular hologram, and the plate is thus additionally exposed to produce a hologram having acceptable contrast. NASA

N70-11260*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESPONSE ANALYZER FOR SENSORS Patent Application
Bobby G. Bynum, inventor (to NASA) and Drayton H. Talley, inventor (to NASA) Filed 30 Jul. 1969 13 p
(NASA-Case-MFS-11204; US-Patent-Appl-SN-845991) Avail: CFSTI CSCL 14B

Details are given on an apparatus for measuring the performance of liquid level sensors under dynamic conditions. The apparatus includes a motor driven cam having a cam groove formed therein. A cam follower riding in the cam groove drives a pivotally mounted lift rod which in turn drives a slide rod to which a sensor being tested is attached. The slide rod is positioned with respect to a container such that the attached sensor is moved in and out of a liquid in the container. A first signal generating means is provided that indicates when the sensor actually first enters the liquid and another signal is generated by the sensor when it senses entering the liquid. By monitoring the time lapse between the signals it is possible to determine the response characteristics of the sensor upon entry into a liquid. A camera and light source are utilized to photograph conditions within the container during test of a sensor. NASA

N70-11281*# Westinghouse Electric Corp., Elmira, N.Y. Electronic Tube Division.
SOLID STATE RADIOGRAPHIC IMAGE AMPLIFIERS Final Report, 1 Jul. 1967 - 30 Apr. 1968
Zoltan Szepesi, Michael Novice, and Thomas Keeton May 1968 35 p refs
(Contract NAS8-21206)
(NASA-CR-102299) Avail: CFSTI CSCL 03B

A solid state radiographic image amplifier system was developed for the direct viewing of radiographic images to substitute the photographic or fluoroscopic method of radiography. It consisted of the combination of a photoconductor electroluminescent (PC-EL) type image amplifier and an image retaining panel. This system ideally combined reasonably short exposure time with long storage and fast erasure; it had a good gain and high contrast sensitivity. An 8 in. × 10 in. panel was delivered to the Marshall Space Flight Center with a resolution of 1400 TV lines (180 lines/inch), maximum output brightness of 7 ft-L at 115 V and 400 Hz, and 3% contrast sensitivity. Its working range was between 0.2 and 20 r/min. A portable, light-weight (9 lbs.) power supply with rechargeable batteries supplied the driving voltage. This radiographic amplifier system proved to be useful for some radiographic applications, specifically for nondestructive testing. However, to increase the field of applications, it is recommended that work be continued for: (1) improving spottiness and uniformity; (2) increasing contrast sensitivity; (3) integrating the storage panel with the amplifier panel; (4) eliminating the effect of ambient light; and (5) constructing the system from space qualified components. Author

N70-11282*# Northrop Nortronics, Norwood, Mass. Precision Products Dept.
GYRO NOISE MEASUREMENTS Final Report
J. W. O'Neill 9 Oct. 1969 16 p
(Contract NAS12-580)
(NASA-CR-86264; PPD-69-E-10288) Avail: CFSTI CSCL 14B

The results of noise measurements which were made on the two models of gyros, which are presently being considered for use in NASA's Tilt and Vibration Isolation System are reported. Previous work has shown sensor noise to be one of the major limitations on the performance capability of an active stable pad. From the results obtained, it is concluded that the GI-V7 gyro is more suitable than the GI-T1-B gyro, from the noise standpoint, for this particular application. Although instrumentation/measurement problems due to test pad perturbations, instrument noise, etc., make it difficult to isolate gyro noise by itself, the relative values obtained make it obvious that the GI-V7-type gyro exhibits much less noise than the GI-T1-B-type gyro. A comparison of the noise content of the two types of gyros plotted as Input Axis Displacement Power Spectrum vs. Frequency is included. Author

N70-11290*# Optonetics, Inc., Teterboro, N.J.
STAR FIELD READER Final Report, 4 Jan. 1965 - 30 Jul. 1968
30 Jul. 1969 66 p ref
(Contract NAS5-9543)
(NASA-CR-106736) Avail: CFSTI CSCL 17H

An engineering model of a star field reader, based on a proprietary solid state light beam scanning technique, was developed. A telemetry conversion unit to interface with the star field reader and an RF link data transmitter was also constructed. The engineering model is two-headed with f/0.95, 3-inch focal length optics and has detected simulated stars of plus 1.7 magnitude with a signal to noise ratio of 20 to 1. The device has a resolution of better than plus or minus 2 arc minutes and utilizes the digital measurement of the angle between two stars. The device demonstrates feasibility for missions where intermittent operation is desirable, within the power and size limitations for satellite requirements. Further environmental work would be necessary to bring the solid state scanner to the point where it would be applicable for NASA space environment specifications. Author

N70-11368 National Lending Library for Science and Technology, Boston Spa (England).
MEASUREMENT DYNAMICS OF THERMOCOUPLES
D. Hofmann 18 Jul. 1969 14 p refs Transl. into ENGLISH from Polish conf.
(NLL-CE-Trans-4956-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: .1 NLL photocopy coupons

Explained is how to determine the dynamic behaviour of thermocouples. Transient responses h(t) were established in terms of type of thermocouple, diameter of thermocouple, and the conditions of heat transfer. An estimate of the structure of the transfer functions F(p) can be obtained from typical courses of the functions ln[1-h(t)]. To obtain the dynamic characteristics in analytical form, the transfer functions were approximated from the averaged transient responses. Different approximation methods are required for the various types of transient responses, and the choice is facilitated by the diagrams provided. A comparison of various dynamic characteristic functions of thermocouples showed F(p), T sub n = f(alpha) to be the most favorable descriptive form from the point of view of the user, as it permits conclusions to be drawn in regard both to the structures and to the coefficients of the transfer functions. The dynamic behavior of thermocouples is in part dependent on the coefficient of heat transfer alpha. Methods of determining this behavior are described. Author

N70-11372# General Motors Research Labs., Warren, Mich. Mechanical Development Dept.
HOLOGRAPHY OF LIQUID DROPLETS
Robert Hickling 10 Apr. 1969 34 p refs
(PB-185570; GMR-869) Avail: CFSTI CSCL 14E

The holograms are records of the light scattered by individual water droplets in the far-field over a range of the scattering angle subtended by the width of the hologram. The radiation patterns of individual droplets in this angular range can be determined from the reconstructed image of the droplet cloud and intensity plots of such patterns were recorded using a TV camera system and a chart recorder with a photo-multiplier attachment. Particular attention was paid to radiation patterns in the angular range of theta from 10 to 40 deg where theta is measured from the direction of propagation of the laser pulse illuminating the droplet cloud. According to the Mie theory of scattering by liquid spheres, a significant relation exists between the form of the scattered radiation pattern and the diameter of a droplet. Author (USGRDR)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N70-10096 National Lending Library for Science and Technology, Boston Spa (England).
ANALYTICAL CALCULATION OF TOOTH PROFILE OF INVOLUTE CYLINDRICAL STRAIGHT TEETH GEAR WHEELS CUT WITH A BASIC RACK TYPE OF TOOL [ANALITICHESKII RASCHET PROFILYA ZUBA EVOLVENTNYKH TSILINDRICHESKIKH PRYAMOZUBYKH KOLES, NAREZANNYKH INSTRUMENTOM REECHNOGO TIPA]
I. I. Leepa [1968] 11 p refs Transl. into ENGLISH from Izv. Vuzov. Mashinostro. (USSR), no. 1, 1967 p 11–16
(NLL-RTS-5057) Avail: Natl. Lending Library, Boston Spa, Engl.: 15s

A formula for defining exact dimensions of tooth profile of straight teeth gear wheels was presented cut with basic rack type of tool. The disposition of the system of coordinates axis made it possible to mark off the tooth profile within a small area, which ensured economy in material and the accuracy in marking off simultaneously two different tooth profiles. Author

N70-10188# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRON-BEAM WELDING OF MOLYBDENUM
Chi-Luan Pan 4 Mar. 1969 36 p refs Transl. into ENGLISH from Ch'i Hsiang Hsueh Pao (Peking), v. 1, no. 2, 1965 p 15–34
(AD-692129; FTD-HT-23-802-27) Avail: CFSTI CSCL 13/8

Optimum parameters were determined for the electron-beam welding of Mo 15 mm thick. Welding was done on a stand type LD-30S of Chinese design. The effect of the degree of the vacuum and of the welding technology on the properties, particularly the ductility, of Mo welds, and the causes of their brittleness were analyzed. Author (TAB)

N70-10209# Road Research Lab., Crowthorne (England).
THE EFFECT OF TYRE CONSTRUCTION ON BRAKING FORCE COEFFICIENTS
J. K. Meades 1969 17 p refs
(PB-184168; RRL-LR224) Avail: CFSTI CSCL 13F

Radial and cross ply tires were compared in terms of peak and slide braking force coefficients at car speeds between 50 and 130 km/h (30 and 80 mile/h) on a range of wet surfaces: one comparison was made with tires having a winter tread pattern and another with tires having a siped pattern. The radial ply tires gave higher peak braking force coefficients on all the surfaces than did the cross ply tires. The difference between these coefficients were almost independent of speed and were least on the coarse-textured surfaces and greatest on the fine-textured surfaces, ranging from almost zero to about 0.1. The radial ply tires gave higher slide braking force coefficients on the fine-textured surfaces but lower coefficients on the coarse-textured surfaces than did the cross ply tires but the differences were smaller than for the peak coefficients ranging from about zero to about 0.05. Author (USGRDR)

N70-10290# TRW Systems Group, Washington, D.C.
MOVING GROUND PLANE WIND TUNNEL TESTS ON SEVERAL TRACKED AIR CUSHION VEHICLE (TACV) MODELS
1 Mar. 1969 222 p refs
(Contract C-353-66)
(PB-183857; TRW-06818-6032-RO-00) Avail: CFSTI CSCL 13F

Test results are presented for four models. Briefly, the objectives of the program were: (a) Determination of whether a moving ground plane simulation is necessary for valid TACV wind tunnel test results. (b) Determination of the aerodynamic characteristics of air cushions. (c) Determination of the aerodynamic characteristics of TACV bodies. Author (USGRDR)

N70-10313 National Lending Library for Science and Technology, Boston Spa (England).
COMPENSATION OF AXIAL FORCES ACTING ON ROTARY PISTON MACHINE ROTORS [KOMPENSATSIYA OSEVYKH USILII, DEISTVUYUSHCHIKH NA ROTOR ROTORNO-PORSHNEVOI GIDRAVLICHESKOI MASHINY]
B. N. Biryukov Jun. 1969 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Gornyi Zh. (USSR), v. 9, no. 7, 1966 p 93–97
(NLL-RTS-4968) Avail: Natl. Lending Library, Boston Spa, Engl.: 12s 6d

A method is described for compensating the axial forces which cause increases in mechanical friction and volumetric losses in rotary piston machine rotors. Compensating chambers placed symmetrically on each distributor disc are closed by the rotor and hydraulically connected to the distribution ports in the opposed discs by special channels provided in the rotor body. Throughout the working cycle, the effect of fluid pressure from each port closed by the rotor on one of its end-faces is balanced by an equal but opposite fluid pressure force loading the other face of the rotor from the compensating chambers. R.B.

N70-10316# Lund Univ. (Sweden). Machine Elements Div.
THE CIRCUMFERENTIAL GROOVE JOURNAL BEARING CONSIDERING CAVITATION AND DYNAMIC STABILITY
Gunnar Lundholm Royal Swedish Acad. of Eng. Sci. 1969 91 p refs *Its* Mech. Eng. Series No. 42
(PB-184647; APS-ME-42) Avail: CFSTI CSCL 13I

Hydrodynamic lubrication of the journal bearing with a circumferential oil groove is studied. The calculations cover variations of the width-to-diameter ratio, relative eccentricity, and oil groove pressure. Load capacity, power loss, oil flow and stability borderlines are given in design charts, from which a bearing with minimum relative power loss and with stable running can be designed. Tests have been made for load capacities, attitude angles, shapes of the cavitation regions, and stability borderlines. Author (USGRDR)

N70-10329*# Wyle Labs., Inc., Huntsville, Ala. Research Div.
NOISE REDUCTION STUDY OF ORBITING WORKSHOP VENTILATION FANS
C. L. Munch May 1969 29 p refs
(Contract NAS8-21260)
(NASA-CR-102287; TM-69-4) Avail: CFSTI CSCL 13A

Noise measurements made by the ventilating fans installed in the Orbiting Workshop indicated excessively high levels, particularly in the Speech Interference Range (octaves 500, 1000, 2000 Hz) where levels of 86 dB were recorded. As a result an experimental program to reduce the noise generated by the ventilating fans was undertaken. The fan assembly was installed without flow straightening vanes inside a longer duct. Acoustic measurements made on this and the unmodified assembly are reported. Removal of the vanes resulted in a SIL reduction of approximately eight dB indicating that much of the noise was generated by the interaction of the stator vanes with the rotor wake. It was found that locating the fan unit in the center of the nine inch duct further decreased the SIL by approximately three dB. The

fan unit, when removed from the duct, generated a SIL of only 51 dB, indicating that the duct geometry was such that the rotor blades were encountering unnecessarily high pressure fluctuations in the duct flow. As a result of the program, the fan unit was modified by cutting away the leading portion of the support vanes effectively moving them further downstream from the rotor, fitting a streamlined bell mouth to the inlet end of the fan duct, fitting a faired nose cone to the rotor hub, and installing an absorptive muffler on the exhaust end of the fan duct. Initial indications were that these steps resulted in substantial noise reductions. Author

N70-10629# Technion--Israel Inst. of Tech., Haifa. Faculty of Industrial and Management Engineering.
ON THE PROBLEM OF ASSEMBLY LINE BALANCING
E. M. Mansoor and M. Yadin (Melbourne Univ.) Apr. 1969 19 p refs *Its* Mimeograph Ser. 38
(Contract F61052-68-C-0014)
(AD-692127) Avail: CFSTI CSCL 13/8

Assembly line balancing involves the sequencing of jobs and their assignment to work stations, according to given precedence relations and the work content of each job, in order to minimize the maximum work content of the jobs which are assigned to each of the stations, that is, to minimize the so-called cycle time. There are two approaches: one being to determine the optimal cycle time for a given number of stations, and the other, being to minimize the number of stations for a given cycle time. Author (TAB)

N70-10559# National Research Council of Canada, Ottawa (Ontario).
FREE PISTON GASIFIER STUDIES. DEVELOPMENT OF A HYBRID SIMULATION
F. Rueter and A. Swiderski Apr. 1969 68 p refs
(NRC-ME-230; NRC-10901) Avail: CFSTI

The processes occurring in a free piston engine may, with certain simplifying assumptions, be described by means of mathematical equations. A mathematical model of the engine, requiring continuous and simultaneous solutions of equations of the form $F = m \cdot a$ and $P \cdot V^n$ = constant, may be constructed. Stepwise solutions of these equations are possible on a digital computer, but the selection of suitable step sizes presents difficulties in that large steps generate gross inaccuracies, while small steps increase greatly the time required for solution. However, continuous rather than stepwise solutions of equations of this form can be made with the electrical analog computer. Other equations, such as those describing the combustion process, the generation of thermodynamic data, and the mass flow and engine performance calculations, are more conveniently handled by a digital computer. Simulation of engine operation is accomplished by using a hybrid model of both types of computers. The unique advantages of both computers are exploited by using the analog computer to generate cylinder pressures and to solve the piston dynamic equations while the digital computer performs the thermodynamic calculations. R.B.

N70-10699*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION TESTING OF THERMOFIT SOLDER SLEEVES
17 Nov. 1969 70 p refs
(NASA-TM-X-53968) Avail: CFSTI CSCL 13H

Data obtained during evaluation testing of thermofit solder sleeve D-101-31 when used on nickel clad copper wire and alloy 63 wire is discussed. The tests performed include voltage drop, peel strength, dielectric strength, water immersion, moisture resistance, high temperature aging, and vibration. A test was conducted to determine the optimum heating time of the solder sleeve to obtain maximum peel strength of the joint. Another test, using additional flux, was performed to obtain better wetting of the shield. It was found that very good wetting of the connection was obtained when the shield braid was prefluxed; however, tests indicated that a corrosive flux residue remained in the connection. Voltage drop and peel strength tests of stub splices, a combination of crimp ferrules and solder sleeves, were included. Author

N70-10697*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A TURBOALTERNATOR GAS-BEARING SYSTEM AT STEADY-STATE CONDITIONS
Roman Kruchowy, James C. Wood, and Joseph S. Curreri Washington Nov. 1969 31 p refs
(NASA-TN-D-5542) Avail: CFSTI CSCL 13I

The results of experimental testing of the gas-bearing system in a Brayton-cycle turboalternator is presented. The turboalternator was tested under design and off-design steady-state conditions. Pressure ratio across the turboalternator was varied from 1.1 to 1.5, alternator output was varied from 0 to 33 kWe, and liquid-coolant flow was adjusted as appropriate. The gas bearings operated satisfactorily throughout the tests. At high alternator outputs, thrust loads in excess of 200 percent of the design value were produced. Author

N70-10699*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ARC GUIDANCE DEVELOPMENT WORK FOR TACK-WELDED JOINTS
James Chadbourne and W. A. Wall 17 Nov. 1969 22 p
(NASA-TM-X-53966) Avail: CFSTI CSCL 13H

In an attempt to leap-frog long tack welds, a reliable tack weld detector was developed to sense approaching tack welds. This sensor is perhaps the most significant development to result from this phase of the program. It is concluded that the present MSFC system should not be located close to the torch when tack welds are employed to hold the weld joint; however, it is recommended that the present electro-inductive system should be considered a boon for the development of an automatic tack welder because of its homing capabilities. With a memory system, it seems feasible that the MSFC developed system could be used with short tack welds. As an evaluation aid, a comparison of MSFC's transducer with the latest optical tracking transducer is drawn to emphasize the strengths and weaknesses of each transducer. Author

N70-10744# Army Foreign Science and Technology Center, Washington, D.C.
GRINDING OF LARGE PLATES AND SHEETS WITH A VARIABLE CROSS SECTION
V. N. Verezub et al 17 Apr. 1969 18 p Transl. into ENGLISH from Samoletostroyenie i Tekhn. Vozdushnogo Flota (USSR), no. 9, 1967 p 125--132
(AD-691988; FSTC-HT-23-103-69) Avail: CFSTI CSCL 13/8

A method has been developed for the finishing of large plane surfaces with varying configurations. The essence of the method is that the sheet is worked with a metal brush made of particles of ferromagnetic powder which is located in the magnetic field. Such a brush, following the magnetic field relative to the surface of the sheet, can fill all of its depressions and perform grinding. TAB

N70-10765# Airborne Instruments Lab., Deer Park, N.Y.
FEASIBILITY STUDY, AUTOMATIC VEHICLE IDENTIFICATION SYSTEM Final Report
M. L. Reiss, H. R. Inhelder, G. F. King, and A. S. Palatnick Jun. 1969 48 p refs
(Contract FH-11-7008)
(PB-185387) Avail: CFSTI CSCL 13F

An Automatic Vehicle Identification System would consist of a transponder, a control or sensing unit, a communication link and a computer. The transponder would be attached to the vehicle, ideally a passive unit, requiring no power, and having no operating effect on the vehicle. As a vehicle bearing one of these transponders comes within range of a roadside interrogator, information would be transferred from the transponder to the roadside interrogator which will uniquely identify the vehicle. This information would be transmitted by the communication link to the

computer to be checked against information stored in the computer memory or be stored itself. This study was performed to determine the feasibility of adopting a national standard for an Automatic Vehicle Identification (AVI) system. Numerous applications for such a system were identified. Author (USGRDR)

N70-10777# State Inst. for Technical Research, Helsinki (Finland).
VACUUM TREATMENT AND MELTING OF STEEL [TERAEKSEN TYHJOEKAESITTELY JA -SULATUS]
P. Asanti, Chr. Ottosson, and J. Maekinen 1969 38 p refs In FINNISH; ENGLISH summary *Its* Ser. 2 Metalli 26
Avail: CFSTI

As the quality requirements on metallic raw materials are growing continuously new methods have to be applied in their manufacture in order to improve the quality. One such method which has become of current interest also in Finland is to use vacuum in the metallurgy of steel and other metals. The State Institute for Technical Research in their metallurgical laboratory undertook to carry out a literature investigation of this subject. The aim set was a generally informative account which would stimulate plans to apply the method. Under these circumstances it was appropriate to carry out an investigation giving the technical information of general nature considered important in connection with the methods in use, without entering into extensive treatment of details. Author

N70-10858*# Sterling (Walter V.), Inc., Los Altos, Calif.
STUDY AND DEVELOPMENT OF NONDESTRUCTIVE WELD INSPECTION TECHNIQUES, PHABE 2 Interim Report
Oct. 1969 134 p
(Contract NAS2-4166)
(NASA-CR-73385; IR-169-2467-05) Avail: CFSTI CSCL 13I

The design of prototype nondestructive weld testers (NDT) and the preliminary results of an evaluation program are presented. The NDT system measures the peak values of weld pulse, infrared, and dynamic setdown and compares them to acceptance limits. Production welds in a manufacturing environment were processed, and included a large number of material combinations and weld energies from 2.8 to 44 watt-seconds. Welds made with 50 percent dynamic setdown, reverse polarity, deviations in welding process, or operator errors were rejected consistently. The major design criteria were noninterference with the operator, no effect on welding characteristics, minimum complexity, measurement integrity, and visual results presented to the operator. Details are given on the general design and the electrical components, and on the evaluation test plan. N.E.N.

N70-10867*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
FULL FLOW WITH SHUT OFF AND SELECTIVE DRAINAGE CONTROL VALVE Patent Application
Joseph J. Paolini, inventor (to NASA) Filed 5 Aug. 1969 11 p
(NASA-Case-ERC-10208; US-Patent-Appl-SN-847596) Avail: CFSTI CSCL 13L

A multi-orifice valve that provides different patterns of fluid flow is disclosed. Selective movement of a valve stem in both axial and rotational senses produces various combinations of alignment between transverse bores in the valve stem and multiple orifices in a valve body. NASA

N70-10900*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
[A TUNED DAMPED VIBRATION ABSORBER] Patent Application
William B. Igoe, inventor (to NASA) Filed 30 Jun. 1969 12 p
(NASA-Case-LAR-10083-1; US-Patent-Appl-SN-837825) Avail: CFSTI CSCL 13F

Details are given on a tuned damped vibration absorber for a mass vibrating in more than one degree freedom of motion. It consists of a cantilever spring and attached mass designed so that they will absorb vibrations simultaneously at different frequencies in corresponding different degrees of motion. NASA

N70-10969*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ALTITUDE DETERMINATION USING A BINOCULAR VIEWER
Jacob H. Lichtenstein and William T. Suit Washington Nov. 1969 22 p refs
(NASA-TM-X-1926) Avail: CFSTI CSCL 17H

An evaluation of an optical viewing device, called a binocular viewer, and its aid to an observer in estimating his altitude above a spherical surface with a radius of 1080 miles (1737.7 km) was made. The observer used the method of matching the horizon curvature, as seen through the viewer, with previously calibrated arcs that also appear in the viewer to indicate the altitude. Twenty-three subjects were used and the simulated altitudes varied from 0 to 115 miles (0 to 185 km). The results showed that the formation of the optical surfaces was very critical, and that minor errors in the surface could appreciably affect the estimated altitude. In addition, it was found that the observers could estimate their altitude to within plus or minus 5 miles, and that whether or not the observer needed corrective lenses had no appreciable effect on the results. Author

N70-11012# Atomic Energy Commission Research Establishment, Risö (Denmark). Metallurgy Dept.
PILOT PLANT FOR MANUFACTURE OF URANIUM DIOXIDE PELLETS
O. Toft Sorensen Mar. 1969 31 p refs
(RISO-197) Avail: CFSTI

In connection with the Danish fuel-element programme a pilot plant for manufacture of natural as well as enriched UO_2 powder and pellets was developed. The methods, equipment and the results obtained during a typical manufacturing run of UO_2 pellets for an irradiation experiment are described. Author (ESRO)

N70-11017# British Iron and Steel Research Association, London (England). Metallurgy Div.
THE CURRENT POSITION OF THERMOMECHANICAL TREATMENTS APPLIED TO ENGINEERING AND TOOL STEELS
D. J. Latham 1969 28 p refs
(PB-185428; MG/A/39/69) Avail: CFSTI CSCL 13H

The current position in the development of thermomechanical treatments as applied to several engineering and tool steels is reviewed. Attractive combinations of strength and toughness can be produced depending on alloy composition and the operational conditions. The primary advantages of these techniques have been considered in terms of increased strength/weight ratio, improved fatigue life and the possible upgrading of cheaper materials to meet more stringent specifications. The use of thermomechanically treated components appears to be limited to specialised applications. Author (USGRDR)

N70-11025# Honeywell, Inc., Hopkins, Minn.
A STUDY OF GRINDING DAMAGE IN MAGNESIUM OXIDE SINGLE CRYSTALS
Barry G. Koepke and Robert J. Stokes Jul. 1969 42 p refs
(Contract N00014-69-C-0123)
(AD-691284; HR-69-283-5-26; TR-1) Avail: CFSTI CSCL 11/2

The nature and extent of the damage introduced into magnesium oxide crystals by surface grinding has been studied as a function of wheel type and rate of material removal. Two types of damage were observed: sub-surface deformation and surface topography. Both the sub-surface damage and surface topography are discussed in terms of the stresses and temperatures existing at the wheel-workpiece interface during grinding. Author (TAB)

N70-11131*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTI-DUCTED ELECTROMAGNETIC PUMP Patent Application
Jerry P. Davis, inventor (to NASA) and Gerald M. Kikin, inventor (to NASA) Filed 16 Apr. 1969 15 p
(Contract NAS7-100)
(NASA-Case-NPO-10755; US-Patent-Appl-SN-816733) Avail: CFSTI CSCL 13L

An apparatus for pumping conductive liquids is described which comprises a single toroidal electromagnetic pump structure wherein there are a plurality of pump passages with each passage having a two pump duct sandwich therein. Each pump duct has associated with it a plural tube header assembly connected to its input and output portions. Each tube of the plural tube header assemblies is electrically insulated from adjacent tubes thereby minimizing the bypass current flow. Current flows through each twin pump duct combination are in a counter flow arrangement to minimize field distortion. The single toroidal pump structure may therefore comprise any convenient number of individual pumps formed within the compact configuration. NASA

N70-11133*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIBRATION ISOLATION SYSTEM Patent Application
Robert M. Norman, inventor (to NASA) Filed 29 Jul. 1969 14 p
(Contract NAS7-100)
(NASA-Case-NPO-11012; US-Patent-Appl-SN-845807) Avail: CFSTI CSCL 13I

A simplified shock absorber system particularly adapted for mounting test specimens in environmental test chambers is described. The invention employs a plurality of vibration isolation devices suspended between the base and the mount in a manner such that the mount is supported by the isolation devices suspended from the base. Each of the isolation devices includes a pair of pull-apart helical compression springs operatively coupled with load-supporting turn buckles through a pair of tension rods and a compression plate so that forces of vibration are absorbed by the springs acting in compression. By employing a pair of compression springs for supporting a load under test, a suspension system of reduced bulk and complexity is provided. Furthermore, since short lengths of compression springs are employed, the springs may be compressed and secured in a compressed state to provide a hard mount particularly suited for assembly and adjustment pruposes. NASA

N70-11141# Sandia Corp., Albuquerque, N. Mex.
RADIANT TARGET HEATER SYSTEM FOR ELEVATED TEMPERATURE HUGONIOT EQUATION OF STATE EXPERIMENTS
John A. Brammer Jul. 1969 28 p refs Sponsored by AEC
(PB-185571; SC-DR-69-409) Avail: CFSTI CSCL 13A

A heater system to permit investigations of material dynamic response to shock-loading at elevated temperatures has been developed and adapted to a 10 cm. nominal bore gas gun. Initial elevated temperature experiments have been performed on aluminum to 370C, although target temperatures to around 1000C may be reached with the heater system. The relatively uncomplicated system is compatible with most currently used shock-loading instrumentation techniques, and is not destroyed during each test. Development and design of the system are described. Author (USGRDR)

N70-11182*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POSITIONING MECHANISM Patent Application
Kenneth G. Johnson, inventor (to NASA) Filed 7 Aug. 1969 11 p
(Contract NAS7-100)
(NASA-Case-NPO-10679; US-Patent-Appl-SN-848282) Avail: CFSTI CSCL 13I

A positioning mechanism is described for converting translatory motion into rotary motion. Especially adapted for precision instrumentation, the mechanism includes a lead screw having a carriage threadedly mounted thereon and a sector pivotally mounted about a fixed axis normal to that of the lead screw and connected to the carriage by means of a pair of flexible bands. The sector is also provided with adjustment means for maintaining each of the bands in a taut condition between the carriage and the sector. Upon translatory movement of the carriage by rotation of the lead screw, the sector is drawn about its pivot by the carriage via the bands. NASA

N70-11262# Royal Aircraft Establishment, Farnborough (England).
AXIAL FLOW IN GAS LUBRICATED JOURNAL BEARINGS
E. U. Trevorrow Apr. 1969 15 p refs
(RAE-TR-69070) Avail: CFSTI

This report gives an analytical solution for the axial flow of gas in gas-film lubricated journal bearings with film thickness varying around the journal, when subjected to different constant end pressures. The mass flow formulae are shown to be the same as for stationary concentric circular cylinders, except that the clearance cubed is replaced by the mean of the clearance cubed. An extended form of Elrod's mass content rule is also obtained. Author (ESRO)

N70-11363*# Brown Engineering Co., Inc., Huntsville, Ala. Aerospace Support Div.
INVESTIGATION OF BRAZED AND WELDED CONNECTIONS
James B. Cahill Sep. 1969 119 p refs
(Contract NAS8-20073)
(NASA-CR-61310; ASD-ASTN-1000) Avail: CFSTI CSCL 13H

Three connection types were subjected to a series of environmental tests. Sizes tested ranged from 1/4-inch diameter to 1-1/2-inch diameter tubing. A total of 416 specimens were subjected to 2,395 tests. All three connection types met test procedure requirements when subjected to the proof pressure, leak, storage, extended pressurization, liquid nitrogen temperature soak, +500 F temperature soak, impulse, tensile, and burst pressure tests. All of the brazed connections and none of the welded connections exhibited corrosion due to the corrosion test. Acceptable stress levels were tabulated for connections subjected to vibration tests at room, liquid nitrogen, and +500 F temperatures. A number of discrepancies in fabrication were found. All three types of semipermanent connections, with stricter manufacturing quality control, appear to be equally suitable for space vehicles. The limitations found in the corrosion and vibration testing should be taken into consideration in application of the connections. Author

N70-11365*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROLLING-ELEMENT LUBRICATION WITH FLUORINATED POLYTHER AT CRYOGENIC TEMPERATURES (160 DEG TO 410 DEG R)
Marshall W. Dietrich, Dennis P. Townsend, and Erwin V. Zaretsky Washington Nov. 1969 16 p refs
(NASA-TN-D-5566) Avail: CFSTI CSCL 13H

Rolling-element lubrication tests were conducted at temperatures from 160 deg to 410 R (89 to 227 K) in a modified NASA five-ball fatigue tester with SAE 52100 steel balls. Fluorinated polyether fluids of four different viscosity levels were used as the lubricant. Test results indicated that these fluids have the ability to form elastohydrodynamic films at cryogenic temperatures. At outer-race temperatures below the fluid pour points, these fluids had the ability to provide sufficient lubrication in this system. A linear correlation was developed between upper-ball (inner-race) temperature and measured lubricant temperature. Upper-ball (inner-race) temperature increased with increasing stress at the same rate for all four viscosity levels. Author

N70-11373# Bureau of Mines, Washington, D.C.
OPERATING CHARACTERISTICS OF A HIGH-TEMPERATURE ELECTROSTATIC PRECIPITATOR

C. C. Shale and G. E. Fasching Jul. 1969 22 p refs
(PB-185549; BMRI-7276) Avail: CFSTI CSCL 13H

A semicommercial, high-temperature electrostatic precipitator and adjunct equipment are described, and operating characteristics at 1,470F and 80 psig are presented for both positive and negative polarity. Removal efficiency for negative corona was about 91 to 96 percent while that for positive corona was only about 75 to 77 percent. Results are compared with those from bench-scale investigations, and equipment limitations are discussed. Theoretical aspects of the precipitation process are related to the operating characteristics. Author (USGRDR)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N70-10193*# Techtran Corp., Glen Burnie, Md.
EMISSION SPECTROSCOPY WITH LASER EXCITATION
Yasmuitsu Katsuno et al Washington NASA Nov. 1969 31 p refs Transl. into ENGLISH from Bunseki Kagaku (Tokyo), v. 3, no. 3, 1968 p 376 - 394
(Contract NASw-1695)
(NASA-TT-F-12681) Avail: CFSTI CSCL 20E

The laser microprobe principles and applications are given. Q-switching, the utilization of auxiliary spark excitation, and alternate means of focusing the laser beam are covered. Applications in metallurgy, mineralogy, archeology, and biology, citing the literature, are presented as are problems associated with sample contamination in auxiliary spark excitation. It was concluded that contamination is caused by electrode vaporization and thermal and light effects. The laser microprobe is compared to the X-ray microanalyzer.
Author

N70-10568*# Techtran Corp., Glen Burnie, Md.
SPECTROSCOPIC ANALYSIS WITH THE LASER MICROPROBE
Yasumitsu Katsuno et al (Nagoya Univ.) Washington, D.C. NASA Nov. 1969 13 p refs Transl. into ENGLISH from Bunko Kenkyu (Tokyo), v. 16, no. 4, 1968 p 151 - 157
(Contract NASw-1695)
(NASA-TT-F-12677) Avail: CFSTI CSCL 20E

The applications of laser microprobe for the spectrochemical analysis were studied on some specimens. The laser microprobe was mounted on an optical bench with a Littrow type spectrograph. The laser effect on specimens and the characteristics of spectra resultnd from laser fire with or without auxiliary spark excitation have been observed. The intensities and the precision of the measured spectral line were investigated under some spark conditions. The preparation of standard samples was studied and the analytical curves of Cu, Fe, Cr, Ag and Pb have been obtained. The laser microprobe has been successfully applied to various samples, archaeological analysis of old china, and a medical consideration on the tissues of cancerous and normal prostates. Author

N70-11046# General Telephone and Electronics Labs., Inc., Bayside, N.Y. Bayside Lab.
HIGH ENERGY PULSED LIQUID LASER Semiannual Technical Summary Report, 1 Jan.–31 Jul. 1969
H. Samelson, A. Lempick, C. Brecher, and R. Kocher Jul. 1969 68 p refs
(Contract N00014-68-C-0110)
(AD-691273; SATSR-1 TR-69-826.8) Avail: CFSTI CSCL 20/5

Aprotic liquid laser solutions (Nd(+3):SeOCl2:SnCl4, Nd(+3):POCl3:SnCl4 and Nd(+3)TFA:POCl3:ZrCl4) were evaluated in terms of their spectroscopic and laser properties. The emission and absorption spectra and the transition cross section for the laser are presented and compared with those for glass. The efficiency, loss and laser output are given for various system parameters and the results compared with some values for glass in a similar experimental setup. Initial results are given for stimualted Brillouin and stimulated Raman scattering from the laser solutions. Finally, the hydrodynamic behavior of a glycerin-water solutin with a 12 centipoise viscosity (comparable to the liquid laser solutions) is described. These experiments were carried out in actual laser cells or plastic prototypes. It is shown that such circulating solutions exhibit good optical properties. Author (TAB)

N70-11218# Lockheed Missiles and Space Co., Palo Alto, Calif.
INFLUENCE OF HYDROGEN ON THE GENERATION AND DISSIPATION POWER IN A CARBON DIOXIDE LASER
E. N. Lotkova et al 1969 2 p refs Transl. into ENGLISH from Khim. Vysok. Energ. (USSR), v. 3, no. 5, 1969 p 476 - 478
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Gas composition and generation power in a carbon dioxide laser were investigated as a function of the discharge time in a tube with low-oxidizing Mo and Pt electrodes. The effect of hydrogen on the degree of carbon dioxide dissociation and the generation intensity was also studied. Tests indicated: (1) Hydrogen is always present in the final mixture after the discharge, possibly because it is liberated from the electrodes and formed from water impurities during the discharge. (2) Generation intensity increases when hydrogen is added, and reaches a maximum for a hydrogen content equivalent to 10 percent of the quantity of carbon dioxide. (3) The hydrogen admixture effect on a laser system is governed primarily by suppressed dissociation of the working gas. M.H.E.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N70-10101*# Techtran Corp., Glen Burnie, Md.
THE SURFACE STRUCTURE OF VAPOR DEPOSITED RANEY NICKEL FILM AND ITS CATALYTIC ACTIVITY
I. Nakabayashi et al Washington NASA Oct. 1969 11 p refs Transl. into ENGLISH from Kogyo Kagakuzasshi (Tokyo), v. 90, no. 4, 1969 p 344 - 347
(Contract NASw-1695)
(NASA-TT-F-12628) Avail: CFSTI CSCL 11F

Metallurgical reflection microscopy of the surface structure of a sandwiched Raney alloy film was prepared by the vapor deposition of aluminum and nickel, and a Raney nickel film developed in an aqueous solution of sodium hydroxide. An analysis was also made of the composition of the nickel aluminum alloy and of the surface structure of the Raney nickel film by X-ray diffraction. On the basis of these observations and analytical results, correlation was made between the surface structure and the catalytic activity of the Raney nickel film in hydrogenation reactions. The nickel aluminum alloy begins to form within the vapor deposited film during heat treatment at temperatures higher than 450 C. Two types of intermetallic compounds, nickel trialuminide and dinickel trialuminide were detected, but no nickel aluminide was present. Alloy films that were formed at various heating temperatures were developed in aqueous solutions of sodium hydroxide and a study made of the catalytic activity of these samples in the acetone hydrogenation reaction. Author

N70-10107# European Atomic Energy Community, Karlsruhe (West Germany). European Transuranium Inst.

SOME CONSIDERATIONS ON THE GRAVIMETRIC DETERMINATION OF THE OXYGEN TO METAL RATIO IN PLUTONIUM OXIDES AND MIXED URANIUM-PLUTONIUM OXIDES

M. J. Maurice and K. Buijs 1969 26 p refs
(EUR-4296-e) Avail: CFSTI

The sample is weighed, equilibrated with air or a mixture of carbon monoxide and carbon dioxide respectively 850 – 900 C, and reweighed. Results obtained with more than 130 samples are analyzed and special attention is paid to the influence of the precision of the weighing on the precision of the final result. The influence of different possible types of inhomogeneity in samples is discussed. Author

N70-10149# Bureau of Mines, Reno, Nev. Metallurgy Research Center.

HEAVY METALS PROGRAM: GOLD RECOVERY FROM SCRAP ELECTRONIC SOLDERS BY FUSED-SALT ELECTROLYSIS

E. K. Kleepiex, J. P. Bennetts, and T. A. Henrie Mar. 1969 10 p refs
(PB-184309; TR-9) Avail: CFSTI CSCL 11F

The report discusses a process for recovering gold and refining tin-lead solders from scrap solder discarded by the electronics industry. Contaminated solder can be refined by electrotransport in a molten-salt chloride electrolyte. Refined solder is recovered at the cathode, and the gold and other metal impurities are concentrated at the anode, increasing gold concentration from 60 to 15,000 oz/ton without any significant loss. The gold is then reclaimed by conventional fire-refining methods. Author (USGRDR)

N70-10178# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PROPERTIES AND USE OF REFRACTORY ALLOYS Selected Articles

26 Feb. 1969 80 p refs Transl. into ENGLISH from Svoista Primen. Zharoproch. Splavov, Akad. Nauk SSR, Inst. Met. (Moscow), 1966 p 15 – 24, 35 – 39, 99 – 104, 159 – 162, 183 – 189, 194 – 201, 213 – 218, and 280 – 290
(AD-692042; FTD-HT-23-332-68) Avail: CFSTI

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2. CERTAIN REGULARITIES IN THE SOFTENING BEHAVIOR OF METALS AS A FUNCTION OF TEMPERATURE V. S. Ivanova et al p 11 – 17 refs (See N70-10180 01-17)

3. STRENGTH AND DUCTILITY OF CERTAIN SINGLE PHASE AND BINARY NIOBIUM BASED ALLOYS OBTAINED BY ELECTRON BEAM MELTING B. A. Movchan et al p 18 – 24 refs (See N70-10181 01-17)

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7. DUCTILE CREEP RESISTING Nb-Ni-Al ALLOY SYSTEMS R. S. Mints et al p 45 – 46 refs (See N70-10185 01-17)

8. A STUDY OF THE KINETICS OF HARDENING AND SOFTENING OF CREEP RESISTING ALLOYS WITH THE OBJECT OF SELECTING THE TEMPERATURE RANGES FOR HOT PLASTIC DEFORMATION AND HEAT TREATMENT N. N. Zhetvin et al p 47 – 52 refs (See N70-10186 01-17)

9. INVESTIGATION OF THE CREEP RESISTANCE OF ALLOYS OF TUNGSTEN WITH NIOBIUM AND TITANIUM I. Yu. Lazareva et al p 53 – 59 refs (See N70-10187 01-17)

10. INVESTIGATION OF THE OXIDATION OF NIOBIUM ALLOYED WITH VANADIUM, TITANIUM AND ZIRCONIUM D. A. Prokoshkin et al p 60 – 65 refs (See N70-10188 01-17)

N70-10179# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PRODUCTION AND PROPERTIES OF SINGLE CRYSTALS OF REFRACTORY METALS AND ALLOYS

Ye. M. Savitskiy et al *In its* Properties and Use of Refractory Alloys 26 Feb. 1969 p 1 – 10 refs (See N70-10178 01-17)
Avail: CFSTI

By employing the method of electron beam zone melting in vacuum and recrystallization, single crystals of V, Nb, Ta, Mo, W, Re, and Ru, as well as Mo-Nb, Mo-W, and W-Nb were produced. The purity of the single crystals were verified by measuring the residual electrical resistance at 4.2 K, or by measuring the number of bendings at 90 or 180 deg. Increased purity resulted in considerable decrease of tensile strength, and hardness as well as increase of plasticity and elasticity modulus. Single crystals of W and Mo exhibited anisotropy of tensile strength and plasticity, e.g. minimum relative elongation 2% and constriction 0% in the direction (100) and maximum elongation 10-12% and constriction 100% in the direction (110). Author

N70-10180# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN REGULARITIES IN THE SOFTENING BEHAVIOR OF METALS AS A FUNCTION OF TEMPERATURE

V. S. Ivanova et al *In its* Properties and Use of Refractory Alloys 26 Feb. 1969 p 11 – 17 refs (See N70-10178 01-17)
Avail: CFSTI

On the basis of the hypothesis of the energy similarity of rupture and fusion of metals, the dependence of the spontaneous energy of rupture was considered. It is possible to calculate the spontaneous energy of rupture from the thermodynamic constants data of the metals, and to detect the temperature of rupture which makes strain hardening impossible (the temp. of the beginning of the metal weakening). As an example, with Ta, Cu, and Al, there is good agreement between the calculated and extrapolated values of spontaneous energy of rupture. Also for pure Al, Cu, Fe, Ni, and V, the temperature of rupture corresponds to the inflection point in the curve of hardness or other strength characteristics. Author

N70-10181# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STRENGTH AND DUCTILITY OF CERTAIN SINGLE PHASE AND BINARY NIOBIUM BASED ALLOYS OBTAINED BY ELECTRON BEAM MELTING

B. A. Movchan et al *In its* Properties and Use of Refractory Alloys 26 Feb. 1969 p 18 – 24 refs (See N70-10178 01-17)
Avail: CFSTI

Alloys of Nb with W 5-16.5, Mo. 0-6.2, Zr 0-4.0, V 0-1.32% were studied. The strength of these alloys was measured in the 1000-1400 deg temperature range. The alloying of Nb by the groups IVa-VIa elements in the limits of the formation of solid solutions ensures the formation of high-strength alloys with a high room-temperature plasticity. The addition of 0.1% C to these alloys has a beneficial effect on the strength of the alloy matrix. Author

N70-10182# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF CONDITIONS OF HEAT TREATMENT OF THE Ni-Cr-Ti-Al ALLOY ON THE LATTICE CONSTANT OF THE SEGREGATION PHASE

V. V. Zhukov *In its* Properties and Use of Refractory Alloys 26 Feb. 1969 p 25–29 refs (See N70-10178 01-17)
Avail: CFSTI

The experiments were carried out on polycrystalline samples of an industrial alloy (20% Cr, 2.57% Ti, 0.87% Al), subjected to hardening with heating to 1090 plus or minus 5 deg with holding times of 2 and 8 hours and subsequent cooling in air. Part of the samples, hardened with a holding time of 8 hours, were aged for 40 hours at temperatures of 700, 800, and 900°. After removal of the surface layer to a depth of 1.5 mm the samples were subjected to x-ray analysis to determine the lattice constants of the matrix and the segregated phases. Experimental results are shown in tabular form, for commercial alloy EI437. It was found that the value of the lattice constant for the segregated phase does not depend on whether its particles are isolated from the matrix or not; it therefore depends in an almost linear manner on the chromium concentration; above all, it is a function of the chemical composition, which can vary considerably with heat treatment conditions, thanks to the different diffusion mobility of the components conditions, thanks to the different diffusion mobility of the components which form a segregated phase (titanium, aluminum) or which are soluble in it (chromium). Author

N70-10183# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERCRYSTALLINE STRENGTH AND PHASE COMPOSITION OF Ni/Cr BASED ALLOYS
Ye. Ye. Levin et al *In its* Properties and Use of Refractory Alloys 26 Feb. 1969 p 30–37 refs (See N70-10178 01-17)
Avail: CFSTI

Alloys EI617 and EI826 after aging at 850 deg for 3000 and 10,000 hrs., resp., showed a much decreased plasticity at 850 deg; the level of elongation and constriction dropped to 5, 8, and 5-7, 5-7% resp. However, tensile strength dropped only to 59 and 64 resp. (from initial 71 and 81, resp.). On the other hand in testing at 850 deg for long range strength both these alloys showed only small decrease in plasticity after testing for 1808 and 5051 hrs., resp. This is explained by the localization of carbides (M23C6 and M'M' 'C) as well as intermetallides Co7W6 primarily along grain boundaries, which results in the initiation of cracks along these boundaries. The plasticity and strength deteriorate primarily in testing at room temperature while at higher temperatures and longer testing periods the harmful effect of these "brittle" phases is less pronounced. Author

N70-10184# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF THE ADSORPTION ACTIVITY OF THE ALLOYING ELEMENTS ON THE CHARACTER OF DISTRIBUTION OF EXCESS PHASES AT THE GRAIN BOUNDARIES OF NICKEL BASED ALLOYS
V. Ye. Olshanetskiy et al *In its* Properties and Use of Refractory Alloys 26 Feb. 1969 p 38–44 refs (See N70-10178 01-17)
Avail: CFSTI

The relative change in free energy in the transition from like grain boundaries to unlike grain boundaries is determined. A formula is presented for segregated phases with a lattice character, and another is developed for segregated phases of spherical form. Author

N70-10185# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DUCTILE CREEP RESISTING Nb-Ni-Al ALLOY SYSTEMS
R. S. Mints et al *In its* Properties and Use of Refractory Alloys 26 Feb. 1969 p 45–46 refs (See N70-10178 01-17)
Avail: CFSTI

The study of the microstructure and x-ray analysis of the system Ni-Ni3Al-Ni3Nb from the side of Ni-Ni3Al up to 20 wt. % Nb showed the existence of 3-phase regions: region gamma on the basis of Ni, region gamma prime on the basis of Ni3Al, and the 2-phase region gamma + gamma prime. Alloys in the 2-phase region showed the highest heat resistance and the following mech. properties: tensile strength: 106-119 kg./sq mm., relative elongation 10-20, constriction 19-30%, and impact strength 6-12 kg./sq cm. Author

N70-10186# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF THE KINETICS OF HARDENING AND SOFTENING OF CREEP RESISTING ALLOYS WITH THE OBJECT OF SELECTING THE TEMPERATURE RANGES FOR HOT PLASTIC DEFORMATION AND HEAT TREATMENT
N. N. Zhetvin et al *In its* Properties and Use of Refractory Alloys 26 Feb. 1969 refs p 47–52 (See N70-10178 01-17)
Avail: CFSTI

The study was carried out on kinetics and temperature ranges of formation of hardening, intermetallic phases of the type Ni3Al and Ni3(Ti, Al) in dispersion-hardened Ni base alloys EI828 and EP460. (C 0.03, 0.03; Mn traces, –; Si 0.11, 0.07; S 0.006, 0.010; P 0.005, 0.008; Cr 9.55, 8.85; Mo 8.8, 2.24; W 5.01, –; Ti 0.06, 3.0; B 0.008, –; Al 4.50, 1.8; Ce 0.15, –; Nb –, 1.87 wt. %, resp.). Specimens were hardened at 950-1200 deg and aged for 12 hrs. within the range 650-1000 deg. Mechanical properties, phase composition, and microstructure were determined before and after aging. The low plasticity of the alloy EI828 is caused by the early formation of the hardening phase during cooling in the process of deformation. After 1 hr. of aging the formation of intermetallic phase with hardening occurred for alloy EP460 at 800-950 deg with maximum at 800 deg, while for the alloy EI828 at 650-1050 deg with maximum at 850 deg. Maximum hardness is reached for the alloy ep460 after 2 hrs. holding at 750 deg and for the alloy EI828 after 4 hrs. holding at 800 deg or alternatively after 2 hrs. at 900 deg. Author

N70-10187# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE CREEP RESISTANCE OF ALLOYS OF TUNGSTEN WITH NIOBIUM AND TITANIUM
I. Yu. Lazareva et al *In its* Properties and use of Refractory Alloys 26 Feb. 1969 refs p 53–59 (See N70-10178 01-17)
Avail: CFSTI

Specimens of three series of niobium-base alloys, containing 1–15% vanadium and 1–10% titanium or 1–20% zirconium, and arc melted in an argon atmosphere, were subjected to oxidation tests in air at 900–1200C. It was found that the oxidation rate depends on the composition. The oxidation rate of the Nb-V-Ti alloys with 10% titanium depends primarily on the vanadium content. It gradually decreases with increasing vanadium content and at 1200C reaches a minimum of 6.3 mg/sq cm hr at 5% of vanadium ; then it increases and at 10% vanadium is 20.9 mg/sq cm hr., i.e., even higher than that of unalloyed niobium. The alloy containing 5% V and 10% Ti had the highest oxidation resistance. It was established that 5% vanadium reduces it by 3–6 times. Only zirconium, of the three contents tested, was found to increase the oxidation rate. Author

N70-10188# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE OXIDATION OF NIOBIUM ALLOYED WITH VANADIUM, TITANIUM AND ZIRCONIUM
D. A. Prokoshkin et al *In its* Properties and Use of Refractory Alloys 26 Feb. 1969 p 60–65 refs (See N70-10178 01-17)
Avail: CFSTI

This study shows that the amount of W in scale decreases and of Nb increases with added Nb content, so that in all alloys that Nb content in scale is higher by 2-4% than that in the corresponding metal matrix. Ti is less effective than Nb for heat

resistance of W. The outer layer of scale is preferentially richer in Ti, and the inner layer in W. In all alloys having double layer scale it fuses at 1300 deg, evidently because of the formation of easily fusible eutectics. Besides scale in W-Ti alloys, a layer of subscale is formed with little W and much Ti. In oxidation of alloys W-Nb, W-Ti, and W-Nb-Ti the greatest degree of heat resistance is attained by alloying W with Nb; alloying with 5% and more Ti produces a negative effect in heat resistance above 1200 deg. The positive effect of alloying W with Nb is basically conditioned on the crystal structure of scale and the structure of subscale. It was found, on the basis of results of x-ray-structural, micro-x-ray-spectral, chemical, and metallographic analyses, that the process of oxidation of alloys W-Nb, W-Ti, and W-Nb-Ti is accomplished by way of opposite diffusion O and metals with preferential movement of Nb ions (in the system W-Nb) and Ti ions in the systems W-Ti and W-Nb-Ti towards the front of the reaction. Author

N70-10219+ National Lending Library for Science and Technology, Boston Spa (England)
THE EFFECT OF NUCLEAR IRRADIATION ON THE CHEMICAL CORROSION PROPERTIES OF AUSTENTITIC 18/8 CHROMIUM NICKEL STEELS [DER EINFLUSS EINER NEUTRONENBESTRAHLUNG AUF DIE KORROSIONSCHEMISCHEN EIGENSCHAFTEN EINES AUSTENITISCHEN 18-8-CHROM-NICKEL-STAHLS]
G. Herbsleb et al 20 Apr. 1969 21 p refs Transl. into ENGLISH from Nukleonik. (Heidelberg), v. 11, Sep. 1968 p 228-233 In ENGLISH and GERMAN
(NLL-EE-Trans-1866-(3774.5)) Avail: Natl. Lending Library, Boston Spa, Engl.

The chemical corrosion properties of a stainless austenitic chrome nickel steel, type X 5 CrNi 18 9 was investigated after irradiation with a neutron dose of 4 × 10-19 neutrons per cm sq and compared with the properties of a non irradiated material. The test pieces were subjected to a Strauss test, a Huey test and to a withstand test in boiling 2 n H2SO4 over the active, passive, and transpassive regions of the current potential curve as well as tested in a 1 m NaCl solution to determine its withstand to corrosive pitting. In general no clear effect of the radiation on the corrosion properties was found. A slight increase of the rate of corrosion of irradiated test pieces in nitric acid is possibly a result of the increase in the ferrite content due to the irradiation. Author

N70-10274# Naval Research Lab., Washington, D.C.
CORROSION RESISTANCE OF SOME COMMON METALS TO CONCENTRATED AND 6 PERCENT SOLUTIONS OF LIGHT WATER FIRE-EXTINGUISHING AGENT
A. W. Bertschy and H. B. Peterson 8 Aug. 1969 18 p refs
(AD-692384; NRL-6932) Avail: CFSTI CSCL 13/12

A study was made concerning the corrosion resistance of a group of common construction metals that might come in contact with the fire-extinguishing agent known as light water. The metals examined were exposed to concentrated light water material and to 6% solutions of light water prepared with sea water and with fresh water. Type 304 stainless steel and titanium w3re virtually unaffected by any of the liquids. Overall weight losses for type 6061 aluminum alloy were low, on the order of 2 milligrams per square decimeter per day (mdd). However, localized pitting was observed. Monel had losses of 5 mdd with the light water concentrate. The copperbase metals immersed in the concentrate exhibited weight losses in the range of 10-13 mdd, while steel, lead, and zinc were in the 18-40 mdd range. The corrosive effect of 6% solutions prepared with fresh water was generally not different than with fresh water itself, except for the copper-base alloys. The 6% solutions prepared with sea water gave results generally not different than with sea water itself. A comparison of the light water concentrate test results with earlier tests conducted on protein-type foam concentrates shows the latter to be considerably more corrosive. The limits for corrosion as set forth in the proposed military specification for light water fire-extinguishing concentrate are lower than those in the current federal specification for protein foam concentrate. Author (TAB)

N70-10308# Naval Research Lab., Washington, D.C.
NAVAL RESEARCH LABORATORY Progress Report
Apr. 1969 50 p refs
(PB-183842) Avail: CFSTI CSCL 05B

A technique for investigating the solid-liquid interface of a growing crystal is described. Progress in physical and electrochemistry, radiochemistry, corrosion, and metallurgy are reported. F.O.S.

N70-10337# Boeing Co., Renton, Wash. Commercial Airplane Group
THE EFFECT OF HEAT TREATMENT ON THE FRACTURE TOUGHNESS AND SUBCRITICAL CRACK GROWTH CHARACTERISTICS OF A 350-GRADE MARAGING STEEL
C. S. Carter Jun. 1969 17 p refs
(Contract N00014-66-C-0365; ARPA Order 878)
(AD-692165; D6-22978) Avail: CFSTI CSCL 11/6

The heat treatment response of a 350-grade maraging steel, with the nominal composition 18.5 Ni, 12 Co, 4.6 Mo, 1.4 Ti, balance Fe, has been determined in billet and bar form. When aged at temperatures below 900F, the material was very susceptible to subcritical crack growth, and premature brittle fracture occurred in unnotched tension specimens loaded at a slow strain rate in laboratory air. Fracture mechanics was used to interpret this behavior. Author (TAB)

N70-10348# Brown Univ., Providence, R.I. Div. of Engineering.
A FURTHER LOOK AT WC-Co FROM THE CONTINUM VIEWPOINT
Thomas Wesley Butler Apr. 1969 80 p refs
(Contract AT(30-1)-2394) Avail: CFSTI
(PB-184306; NYO-2394-35; TR-35) CSCL 11F

The report presents a generalized theory to account for strengthening mechanisms in tungsten carbide-cobalt cemented carbides. (USGRDR)

N70-10368*# National Aeronautics and Space Administration. Langley Research Station, Langley Station, Va.
EXPERIMENTAL INVESTIGATION OF ALUMINIDE-COATED Ta-10W FOR HEAT-SHIELD APPLICATIONS
Gregory R. Wichorek and Bland A. Stein Washington Nov. 1969 64 p refs
(NASA-TN-D-5524; L-6624) Avail: CFSTI CSCL 11F

An experimental study was undertaken to determine the applicability of tin-aluminum-molybdenum-coated Ta-10W for heat shield usage. A relatively simple heat shield design with a corrugated skin was utilized to evaluate the aluminide coated tantalum alloy composite. Separate flat heat shield panels and several nested curved shields mounted on a conical model were tested in static air under cyclic heating conditions to 2600 F. The corrugated heat shields were able to accommodate large temperature differences between the shield and the underlying structure with no loss of structural integrity. The time to coating failure on the heat shields was substantially less than that predicted from small coupon data under static conditions. In view of the oxidation performance of the heat shields and the scatter in coupon data, methods to detect or recognize nonuniformities in the coating and the substrate are needed to predict coating life reliably. The coating life on small specimens as determined for 0.1-hour exposures from 2300 F to 2900 F under static air conditions was reduced by a factor of approximately 4 under subsonic airflow conditions. Most significant was the catastrophic failure of the

leading edge specimens as a result of substrate ignition shortly after the first evidence of coating failure at temperatures of 2600 F and above. Metallurgical examinations and tensile data indicate that embrittlement of the aluminide coated Ta-10W sheet may be a serious problem when thin gage sheet is used at temperatures from 2300 F to 2900 F. Author

N70-10371# Drexel Inst. of Tech., Philadelphia, Pa. Dept. of Metallurgical Engineering.

THE ROLE OF THE INTERFACE REGION ON THE MECHANICAL BEHAVIOR OF METAL MATRIX COMPOSITES

A. Pattnaik and A. Lawley Aug. 1969 28 p refs

(Contract N00014-67-A-0406-0001)

(AD-691908; TR-2) Avail: CFSTI CSCL 11/4

The deformation and fracture behavior of directionally solidified Al-CuAl2 composites was studied in compression at room temperature in terms of the associated dislocation structures and fracture detail. In the as-grown condition, the lamellar structure shows fault lines consisting of discrete sub-grain boundaries and terminal lamellae. A uniform cellular structure develops across the Al-rich lamellae (compression axis parallel to the plane of the lamellae) with cell dimensions < or approximately equal to 1 micron limited by the interlamellar spacing. Fracture initiates by cleavage of the CuAl2 lamellae. Voids resulting from separation of the CuAl2 coalesce leading to ductile failure across the adjacent Al-rich lamellae. The path of the self-propagating crack may be along the mid-plane of the CuAl2 lamellae, or at lamellar interfaces. Significant buckling or kinking of the CuAl2 lamellae takes place prior to fracture, the local fracture path following the contour of the lamellae. Observed yield and ultimate strength levels are significantly higher than values calculated from the rule of mixtures; the strength of the composite approaches that of the CuAl2 phase alone. This is discussed in terms of the mode of loading and of the effect of small interlamellar spacings < or approximately equal to 10 microns on strength. Author (TAB)

N70-10372# Naval Research Lab., Washington, D.C. Strength of Metals Branch.

STANDARD METHOD FOR THE 1-INCH DYNAMIC TEAR TEST

P. P. Puzak and E. A. Lange Feb. 1969 22 p refs

(AD-692382; NRL-6851) Avail: CFSTI CSCL 14/2

The report describes a standard method for conducting dynamic tear (DT) tests to determine the DT energy (fracture toughness) value for structural base metal and weld metal using the standard 1-in. DT test specimen. A description of the apparatus, the dimensions and preparation of specimens, and details of the testing procedures are given. Use of this standard method is recommended for specification purposes, and it provides for comparison of results between different laboratories on a common basis. Author (TAB)

N70-10448# Boeing Co., Renton, Wash. Commercial Airplane Div.

ENVIRONMENTAL FATIGUE CRACK PROPAGATION OF ALUMINUM ALLOYS AT LOW STRESS INTENSITY LEVELS Research Report

J. A. Feeney, J. C. Mc Millan, and R. P. Wei May 1969 30 p refs

(Contract N00014-66-C-0365; ARPA Order 878)

(AD-692166; D6-60114) Avail: CFSTI CSCL 11/6

The environmental fatigue crack propagation in 2024-T3, 7075-T6, and 7178-T6 was studied at low levels of cyclic amplitude of stress intensity, delta K. Both wedge force loading and remote loading techniques were employed to achieve the desired delta K levels, and preliminary experiments were designed to test their compatibility. Testing was carried out in humid air, distilled water, and 3.5% sodium chloride solution, and the observed crack growth rates compared with those in desiccated air. Later studies were also conducted in an inert reference environment with a total water content of less than 2 ppm. When the data are plotted as log delta K versus log d2a/dN, alloy 2024-T3 exhibits a marked slope transition, alloy 7075-T6 a slight slope transition, and alloy 7178-T6 a rectilinear behavior throughout the whole range of delta K studied. The basic shape of these curves is discussed in terms of state-of-stress conditions at the crack tip, frequency effects, environmental effects, strain rate sensitivity, and metallurgical structure. An attempt is also made to correlate the rate of fatigue crack propagation in a particular environment and at a particular delta K level with the fracture topography. Author (TAB)

N70-10452# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.

INTERNAL FRICTION AND ULTRASONIC YIELD STRESS OF THE ALLOY 90-Ti 6 Al 4-V

W. P. Mason and J. Wehr Jun. 1969 41 p refs Sponsored in part by ARPA

(Contract Nonr-266-91)

(AD-692427; TR-65) Avail: CFSTI CSCL 11/6

The alloy 90Ti 6Al 4V has been suggested for use in the supersonic plane. It also has been used as a mechanical transformer for increasing the strain in a sample whose high amplitude and fatigue properties are to be studied. Hence it is important to determine its internal friction and modulus defect at both low amplitude and high amplitude vibration levels. Author (TAB)

N70-10486# Drexel Inst. of Tech., Philadelphia, Pa. Dept. of Metallurgical Engineering.

THE ROLE OF THE INTERFACE REGION ON THE MECHANICAL BEHAVIOR OF METAL-MATRIX COMPOSITES

M. R. Pinnel, A. Lawley, and A. Pattnaik Jul. 1969 43 p refs

(Contract N00014-67-A-0406)

(AD-691907; TR-1) Avail: CFSTI CSCL 11/4

The objective of the program was to understand the role of the interface on the micromechanics of deformation of metal matrix composites. To this end, yielding, flow, and fracture behavior were correlated with the associated stress state and structural detail. Two specific types of composite material were included in the study conventional fiber-reinforced aluminum-stainless steel, and unidirectionally solidified Al-Cu eutectic. The report covers studies on aluminum-stainless steel composites. Part 1: Correlation of uniaxial yielding and substructure in aluminum-stainless steel composites. Part 2: Fracture behavior of aluminum-stainless steel composites. Author (TAB)

N70-10507# Naval Ship Research and Development Center, Annapolis, Md.

A TECHNIQUE FOR EVALUATING TITANIUM ALLOYS BY MELTING, PROCESSING, AND TESTING MINIATURE INGOTS

Alastair G. S. Morton Washington Jul. 1969 56 p refs

(AD-691245; MATLAB-351; NSRDC-3048) Avail: CFSTI CSCL 11/6

A technique of melting, processing, and testing small (80-gram) rods of titanium alloys was developed. The technique is designed for screening large numbers of alloy formulations to determine those with enough potential for further evaluation. The apparent alloying and microstructural effects and the degree of correlation with plate properties are discussed. Author (TAB)

N70-10544# Aeronautical Research Labs., Melbourne (Australia).

CRACK BRANCHING IN HEAVILY DRAWN CHROMIUM

P. Bullen, F. Henderson, and H. L. Wain Mar. 1969 14 p refs

(ARL/MET-66) Avail: CFSTI

Heavily drawn wires were fractured at temperatures between 20C and −100C at various strain rates. An unusual morphology of fracture resulted in all cases, even when plastic strain or necking preceded fracture. Specimens broke into three pieces: two wire ends with conical fracture surfaces, and a cylindrical chip with

reentrant conical fracture surfaces and with a small hole where the apices of these cones met. Despite some resemblance to a ductile shear failure, evidence shows that the fracture is of brittle, presumably cleavage, type and that the morphology results from crack branching. The conditions at fracture are eminently favorable for crack branching because of the high stress level, the low effective surface energy for fracture, and the highly preferred crystallographic texture which provides (111) planes of low effective surface energy in suitable orientations for propagation of the branched cracks. Author

N70-10552# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STRUCTURE AND PROPERTIES OF REFRACTORY METALLIC MATERIALS Selected Articles

28 Feb. 1968 33 p refs Transl. into ENGLISH from the publ. "Struktura i Svoystva Zharoprochnykh Metallicheskikh Materialov" Moscow, Izd. Nauka, 1967 p 93–96, 127–132, and 313–323 (AD-692133; FTD-HT-23-778-68) Avail: CFSTI CSCL 11/6

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3. COMPARATIVE STUDY OF OXIDABILITY AND HEAT RESISTANCE OF COLUMBIUM-BASE ALLOYS O. S. Ivanov et al p 16–27 refs (See N70-10555 01-17)

N70-10553# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

COLUMBIAN CREEP AT HIGH STRESSES

A. F. Orlov *In its* Struct. and Properties of Refractory Metallic Mater. 28 Feb. 1968 p 1–7 refs (See N70-10552 01-17)

Creep in columbium at high stresses at temperatures ranging from 550 to 1000 degree C was studied. The material studied was remelted in a vacuum arc furnace; it had the following impurity content (wt percent): 0.21 percent Ta, 0.09 percent Ti, 0.08 percent Si, and 0.09 percent Fe. After solidifying, the ingots were forged from a diameter of 34 mm down to 8 mm, and samples were made. One set of samples was tested in the as-forged condition, and another set was vacuum annealed at 1400 degree C for 10 hr and then tested. Creep testing was done in a vacuum at constant stress. The logarithm of the creep rate is given as a function of the reciprocal of the absolute temperature for stresses ranging from 21 to 64 kg/mm (to the second power). A linear dependence occurred for each stress and an activation energy was calculated from the slope of the dependence. By comparing the activation energies at high stresses with the activation energies at high vacancy motion, self diffusion, and vacancy formation, it was concluded that the creep of columbium at high stresses and at the temperatures studied is controlled by the thermally activated motion of vacancies to dislocations which undergo slip. Author

N70-10554# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SPECIFIC FEATURES OF ALLOYING, STRUCTURE, AND PHASE COMPOSITION OF NICKEL-CHROMIUM HEAT-RESISTANT ALLOY WITH COLUMBIUM

K. I. Tereknov *In its* Struct. and Properties of Refractory Metallic Mater. 28 Feb. 1968 p 8–15 (See N70-10552 01-17)
Avail: CFSTI

The structure and phase composition of a nickel–chromium alloy containing columbium, molybdenum, titanium and aluminum were studied. Compositions of the carbides and gamma prime-phase are presented for five different heat treatments. After water quenching from 1000 or 1120 degree C, the alloying elements were fixed in solid solution and a small part of the primary NbCN phase occurred. Slow cooling from these temperatures caused a 10-14 percent decomposition of the gamma prime-phase, and aging increased this amount to 20 percent. The phase composition of the gamma prime-phase varied with heat treatment, although each of the component elements were present. The presence of columbium retarded diffusion and consequent coagulation of the gamma prime-phase, as indicated by given phase compositions of the nickel–chromium alloy for different holding times at high temperatures and under stress. Microstructures are shown of the alloy after quenching and aging. Primary carbides and gamma prime-phase particles were distributed in a matrix of solid solution. As aging proceeded, the gamma prime-phase particles thickened and coagulated. Author

N70-10555# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

COMPARATIVE STUDY OF OXIDABILITY AND HEAT RESISTANCE OF COLUMBIUM-BASE ALLOYS

O. S. Ivanov et al *In its* Struct. and Properties of Refractory Metallic Mater. 28 Feb. 1968 p 16–27 refs (See N70-10552 01-17)
Avail: CFSTI

A study is made of the resistance to oxidation in air of alloys on a niobium base which was proposed for use at temperatures of 800, 900, 1000, and 1200 C. Of the studied alloys prepared by arc melting, the most resistant at temperatures of 800-1000 C are alloy 21 (Nb, 45 percent Ti, 14 percent W, 4.3 percent Al, 4 percent Cr, 0.7 percent Mn) and alloy 28 (Nb, 41 percent Ti, 4 percent W, 5 percent Al, 3 percent Cr, 3 percent V, 1 percent Mn); the weight increment to these alloys in the indicated temperature range fluctuates from 7 to 38 mg/cm (to the second power) per 100 hrs. At 1200 C all the alloys studied have low resistance to oxidation, except alloy 15 (Nb, 40 percent Ti, 5 percent Mo, 8 percent Cr, 5 percent Al, 1 percent Mn), whose weight increment after 150 hrs. of testing is 91 mg/cm (to the second power). Of the alloys containing niobium the alloys 3 (Nb, 16 percent Ti, 4 percent Zr) and 12 (Nb, 10 percent Ti, 3 percent V, 3.75 percent Mo, 1.25 percent Cr) exhibit more than 70 percent greater resistance ot oxidation at 800-1200 C. The effect of a number of elements on the oxidation resistance of niobium alloys is demonstrated for multicomponent alloys containing 40-45 percent Ti. Author

N70-10591# Southampton Univ. (England). Institute of Sound and Vibration Research.

THE MICROSTRUCTURAL APPEARANCE OF THE DISCONTINUITY IN MILD STEEL

Matej Bily and Thomas R. G. Williams Wright-Patterson AFB, Ohio AFML Jul. 1969 34 p refs
(Contract AF-61(052)-862)
(AD-692490; AFML-TR-69-194) Avail: CFSTI CSCL 11/6

The report is concerned with the metallographic characteristics of the discontinuity in the S/N curve of notched mild steel specimens, the discontinuity being associated with plastic yielding at the notch and a change in crack paths from transgranular cracking below to inter-transgranular cracking above it. Detailed studies of the microstructures associated with plastic deformation in monotonic straining was undertaken to provide an explanation for the changes observed at the discontinuity. Theories are submitted to explain both the change in crack paths and the shift in endurances at the discontinuity. Author (TAB)

N70-10605# California Univ., Livermore. Lawrence Radiation Lab.

THE USE OF NITRIDES FOR DISPERSION-STRENGTHENING OF REFRACTORY METALS

J. S. Kane 6 Aug. 1968 12 p refs
(Contract W-7405-eng-48)
(UCRL-50487) Avail: CFSTI

A discussion of the dispersion-strengthening method for giving high-temperature creep resistance to refractory metals and

alloys includes methods for securing the dispersions, choice of metal matrices, intermetallic compounds, precipitation of stable nitrides into solid solutions, production of two-phase co-vapor deposited materials, and potential uses in space power reactor structures. NSA

N70-10607# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
MECHANICAL PROPERTIES OF CARBURIZED AUSTENITIC STAINLESS STEELS AS RELATED TO MICROSTRUCTURE
1 July – 31 December 1968
James K. Stanley Los Angeles SAMSO 31 Jul. 1969 30 p
(Contract F04701-69-C-0066)
(AD-692514; TR-0066(5250-10)-1; SAMSO-TR-69-274) Avail: CFSTI CSCL 11/6

Results are presented for tests carried out on tube tensile specimens of four austenitic stainless steels (AISI Types 304, 316, 321, and 347) carburized in a methane-hydrogen mixture for 1 hr each at 870C (1600F), 925C (1700F), 980C (1800F), and 1040C (1900F). Specimens were carburized on both the external and internal surfaces. The carburized case encompasses two zones: (1) a dark etching area of carbide (Fe,Cr)7C3 and austenite, and (2) a heavily carburized grain boundary area, also (Fe,Cr)7C3, that precedes the bulk carburization area. Both zones are quite brittle and develop cracks under a tensile load. The uncarburized austenite acts in a crack-blunting capacity. Author (TAB)

N70-10664# Southampton Univ. (England). Institute of Sound and Vibration Research.
PLASTIC FLOW AND THE STRESS CONCENTRATION IN MILD STEEL SPECIMENS
M. Bily and T. R. G. Williams Wright-Patterson AFB, Ohio AFML Jul. 1969 29 p refs
(Contract AF-61(052)-862)
(AD-692489; AFML-TR-69-193) Avail: CFSTI CSCL 11/6

Three types of mild steel sheet and one type of round specimens were used to investigate the applicability of some published methods of assessing the plastic stress concentration factor. A comparison between the experimental values of these factors, obtained by means of miniature strain gauges located in the root of the notch, and the calculated ones showed that none of the methods gives reasonably accurate results. Furthermore, the value of the plastic stress concentration factor changes under cyclic load, being different in tension and compression. The direction of the first quarter of a cycle which makes the material yield seems to be the main influencing factor. The compressive start is always more damaging because it leaves the stress concentration effects in tension and washes them out in compression. Author (TAB)

N70-10673*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPARISON OF TENSILE PROPERTIES OF 304L AND 310S STAINLESS IN LIQUID HELIUM
Alfred J. Nachtigall 30 Oct. 1969 18 p refs
(NASA-TM-X-52703) Avail: CFSTI CSCL 11F

Tensile properties of 304L and 310S stainless steel were investigated in liquid helium with unnotched and notched specimens. The yield strength for 310S stainless steel was nearly twice that for 304L stainless steel. The ultimate tensile strength for 310S was about 80 percent of that for 304L stainless steel in the unnotched condition. Tensile strengths of notched unwelded and welded specimens for 310S stainless steel were significantly higher than those of 304L stainless steel. Author

N70-10721# Atomic Weapons Research Establishment, Aldermaston (England).
SURFACE SPRAY FROM EXPLOSIVELY ACCELERATED METAL PLATES AS AN INDICATOR OF MELTING
W. F. Bristow and E. F. Hyde Sep. 1969 31 p refs
(AWRE-O-56/69) Avail: HMSO: 9s 0d

The various forms of spray, such as grass, background, and flow effects, emanating from the surface of explosively accelerated metal plates are described and possible sources suggested. There is a significant correlation between surface effects and melting. It is concluded that the occurrence of some of the visible features depends on the metal being molten and that it is possible to obtain evidence of the state of the metal from high speed dynamic photographs. Author

N70-10722*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ELECTRON MICROPROBE STUDY OF INCLUSIONS IN LEAD TELLURIDE THERMOELECTRIC ELEMENTS
Donald B. Evans (TRW Systems, Inc.) and Lawrence Kobren Washington Nov. 1969 13 p
(NASA-TN-D-5415) Avail: CFSTI CSCL 11F

An electron probe and metallographic examination was performed on a lead–tin telluride alloy doped with manganese dioxide in order to determine the chemical role of manganese and other constituents with respect to contacting and nonmetallic inclusions in the alloy. Analysis indicates that the three distinct types of minor phase inclusions which were observed are composed of mixed manganese oxides, tin, and graphite. Elements bonded to an iron cup were also examined. Results show some diffusion of iron into the alloy but no evidence of an iron–tellurium reaction. No differences in microstructure or manganese distribution were detected between those elements which formed sound bonds and those which did not. Author

N70-10797# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
MAGNETIC STUDY OF SOLID URANIUM-FLUORINE COMPLEXES [CONTRIBUTION A L'ETUDE MAGNETIQUE DE COMPOSES FLUORES SOLIDES DE L'URANIUM]
Albert-Jose Dianoux (Ph.D. Thesis–Lyon Univ., 26 Jun. 1969) Aug. 1969 144 p refs In FRENCH; ENGLISH summary
(CEA-R-3859) Avail: CFSTI

A study of the magnetic susceptibility of uranium V fluorine complexes and the magnetic resonance of fluorine atoms in uranium VI fluorine complexes has made it possible to put forward a structural model for these compounds for which it is impossible, because of the lack of suitable single crystals for X-ray diffraction work, to deduce the exact position of the fluorine atoms. It is shown that it is difficult to interpret the paramagnetism of uranium fluorides since the uranium ions are in low-symmetry sites. A theoretical study of the magnetism of the U(V) ion in complex fluorides of the type M3UF8 (M = NH4, Na, Rb, Cs) leads to an interpretation based on a trigonal deformation of the eight fluorine atom structure surrounding the uranium atom. By applying a Hamiltonian spin formalism and making a systematic use of group theory, it is possible to present the susceptibility calculations very concisely. Study of the resonance and relaxation of the fluorine atoms in powdered uranium VI complex fluorides suggests a structural model in the case of NaUF7. It is shown that the shape of the magnetic resonance absorption lines is strongly affected by the presence of large anisotropic chemical shifts. In the model proposed here, six fluorine atoms are linked to the uranium atom by strongly covalent bonds in a deformed UF8 octahedral structure; the seventh fluorine atom remains ionic. The occurrence of a rotational movement of the octahedron is confirmed by a study of the longitudinal relaxation of the fluorine atoms, the activation energy being 0.46 eV. Author (ESRO)

N70-10806# British Iron and Steel Research Association, London (England). Metallurgy Div.
THE FRACTURE TOUGHNESS OF TWO LOW STRENGTH STRUCTURAL STEELS
D. Elliott and M. J. May 1968 12 p
(PB-185427; MG/E/304/68) Avail: CFSTI CSCL 11F

The variation of C.O.D. with temperature on test pieces of full section size and of standard Charpy dimensions is illustrated

for a 21/4 in thick asrolled mild steel, and a 2 in thick Ducol W-30 in the normalised and tempered condition. The effect on C.O.D. of notch acuity is also considered. Possible methods of obtaining the C.O.D. using angle of bend, notch root contraction and displacement values measured using a linear clip gauge are discussed. The preliminary results illustrate the influence on C.O.D. of test temperature, test piece size, notch acuity and loading rate. Author (USGRDR)

N70-10807# Aeronautical Research Labs., Melbourne (Australia).
UNUSUAL LATTICE DEFECTS IN NON-STOICHIOMETRIC NiAl
A. Ball Jan. 1969 15 p refs
(ARL/MET-60) Avail: CFSTI

Planar defects, which frequently appear to be terminated by a dislocation at one end only, have been observed by transmission electron microscopy in aluminum rich alloys of the ordered body centred cubic phase NiAl. Analyses of their geometry and contrast show that the faults lie on cube planes with displacement and associated dislocation vectors normal to the fault plane. The faults are considered to be platelets of aluminum atoms sandwiched between layers of nickel vacancies. Fault contrast fades with distance from the terminating dislocation as a result of the gradual relaxation of the compressive stresses associated with the configuration. This method of accommodating excess aluminum atoms is discussed with reference to previous density, X-ray and nuclear magnetic resonance results. Author

N70-10819# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
STUDY OF A HETEROGENEOUS 18 Ni (300) MARAGING STEEL
Maria Ronay May 1969 78 p refs
(Contract Nonr-266(91))
(AD-692428; TR-64) Avail: CFSTI CSCL 11/6

The Swiss Federal Aircraft Establishment and The Fatigue Institute of Columbia University are cooperating in a long-range research program on the fatigue performance of high strength steels in aircraft structures. The alloyed steels involved in the program fall into three groups according to carbon content, i.e. steels with medium (0.3-0.4%), relative low (0.1-0.2%) and very low (max. 0.03%) carbon content, the last group consisting of maraging steels. The greatest expectation and interest was focused on the 18 Ni 300 grade maraging steel because of its toughness and weldability coupled with the highest yield strength. Author (TAB)

N70-10829# Columbia Univ., New York. Dept. of Electrical Engineering.
ADAPTATION OF THE AUGMENTED PLANE WAVE METHOD TO RANDOM, THREE-DIMENSIONAL, SUBSTITUTIONAL ALLOYS: APPLICATION TO TITANIUM MONOXIDE
Joel Mark Schoen (Ph.D. Thesis) 14 Mar. 1969 208 p refs
(Contract AT(30-1)-3553)
(PB-184028; CU-3553-15) Avail: CFSTI CSCL 20L

A new perfect crystal technique that is based upon the augmented plane wave (APW) method and the virtual crystal approximation (VCA) is developed to treat random, three-dimensional, substitutional alloys and partially vacant crystals. A model muffin-tin potential for alloys is proposed and extended to non-stoichiometric compounds. Together with the APW-VCA, this model potential is employed to compute the band structure and density-of-states of titanium monoxide as a function of composition and vacancy concentration. The effective mass approximation and an experimental estimate of the electron relaxation time are then used to predict several physical properties of TiO. Author (USGRDR)

N70-10834# British Iron and Steel Research Association, London (England). Metallurgy Div.
THE FRACTURE TOUGHNESS OF A SERIES OF EXPERIMENTAL HIGH STRENGTH STEELS
A. H. Priest and M. J. May 1969 21 p ref
(PB-185433; MG/E/404/68) Avail: CFSTI CSCL 11F

An attempt is made to determine the effects of seven elements commonly alloyed in high strength steels on the strength and fracture toughness. The ultimate aim is to obtain the relevant information necessary for the development of steels having the best combination of both these properties. Factorial designs and analysis offers a quick and effective method for determining the effects and interactions of the seven elements investigated. In this type of design it is necessary to specify high and low levels for the ally additions. Author (USGRDR)

N70-10860# National Aerospace Lab., Amsterdam (Netherlands).
CRACK PROPAGATION IN ALUMINUM ALLOY SHEET MATERIALS UNDER FLIGHT-SIMULATION LOADING
J. Schijve, F. A. Jacobs, and P. J. Tromp Dec. 1968 68 p refs
(Contract F61052-67-C-0076)
(AD-692467; NLR-TR-68117-U;) Avail: CFSTI CSCL 11/6

A large number of flight-simulation tests were carried out on sheet specimens of 7075-T6 and 2024-T3 clad material. A gust load spectrum was adopted and a flight-by-flight loading was applied. The investigation is essentially concerned with macro-crack propagation although a few exploratory tests were conducted on the crack nucleation period. The major trends emerging from tests with a variety of loading programs are: (1) The omission of taxiing loads from the ground-to-air cycles did not affect the crack propagation. (2) The sequence of the gust cycles in a flight (random, programmed, reversed gust cycles) did not have a significant influence on the crack propagation. (3) Omission of gust cycles with small amplitudes systematically increased the crack propagation life. (4) The most predominant effect on the crack propagation was coming from the maximum gust amplitude included in the test. Increasing this amplitude gave a large increase of the crack propagation life. (5) Application in each flight of a single gust load only, namely the largest upward gust load, increased the crack propagation life three times. (6) Omission of the ground-to-air cycle increased the life 1.5-1.8 times. The discussion and the analysis of the results include such aspects as fractographic analysis, possible mechanisms for interaction effects between load cycles of different magnitudes and damage calculations. Author (TAB)

N70-10966*# McDonnell-Douglas Astronautics Co., Newport Beach, Calif. Astropower Lab.
STRESS CORROSION CRACKING OF TITANIUM ALLOYS AT AMBIENT TEMPERATURE IN AQUEOUS SOLUTIONS
T. L. Mackay Washington NASA Nov. 1969 58 p refs
(Contract NAS7-488)
(NASA-CR-1464; SM-49105-F3) Avail: CFSTI CSCL 11F

Beta-forged Ti-8Al-1Mo-1V single edge notch specimens were immune to stress corrosion cracking in aqueous salt solutions at ambient temperature. This appears to be due to a microstructure in which deformation of martensitic alpha phase is restricted by retained beta lamellae. Stabilizing heat treatments in the temperature range, 900 F to 1200 F, reduced fracture toughness and increased susceptibility to SCC. Distribution of the beta-stabilizing element, Mo, as a function of heat treatment was investigated in Ti-4Al-3Mo-1V and Ti-4Al-1.5Mo-0.5V by electron microautoradiography. Increasing solution treatment temperature resulted in increasing the Mo concentration in primary alpha phase. Aging at 900 F produced increased Mo content in the beta phase. In addition to segregation of Mo in beta phase regions adjacent to alpha-beta boundaries, In pure Ti charged with tritium, precipitates were observed at stress levels above 50 percent of Y.S.

at 450 F and 600 F, increasing in amount with temperature. The initial tritium concentration levels were well within equilibrium solubility limits for hydrogen in titanium, indicating that solubility was appreciably lowered by the applied stress. Author

N70-10988# Naval Scientific and Technical Information Centre, Orpington (England).

INVESTIGATION OF THE REASON FOR THE CHANGE IN STABILITY OF CERTAIN PALLADIUM-RHODIUM ALLOYS UPON THEIR INTERACTION WITH HYDROGEN

A. A. Rodina May 1969 10 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (Russia), v. 42, 1968 p 1822-1824

(AD-692230; NSTIC-TRANS-2095, NSTIC-21914169) Avail: CFSTI CSCL 11/6

It is shown by x-ray analysis that deformation of the alloys Pd-1 vol.% Rh, and 80 vol.% Pd-19 vol.% Ag-1 vol.% Rh, resulting from repeated heating and cooling in an atmosphere of hydrogen is connected with an alpha-beta phase transition. In alloys of Pd with 10 vol.% Rh, alpha-beta phase transitions are absent. This explains their high stability in an atmosphere of hydrogen, their permeability to hydrogen being close to that of pure palladium. The addition to the binary alloy Pd-20 vol.% Ag of 1% of Rh appreciably increases the stability of the alloy on interaction with hydrogen. Author (TAB)

N70-11048# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THEORY OF METAL EXTRUSION

I. L. Perlin 26 Feb. 1969 444 p refs Transl. into ENGLISH of the book 'Teoriya Pressovaniya Metallov' Moscow, Izd-Vo Met., 1964 344 p

(AD-690239; FTD-HT-23-616-67) Avail: CFSTI CSCL 11/6

The object of the present book is to expound the theory of extrusion of metals in a more complete form on the basis of a systematization and discussion of the published material. The book is addressed to readers having sufficient background in general engineering discipline, the general theory of metal processing by pressing, and physical metallurgy; the basic theorems from these fields are used by the author without any explanation. Author (TAB)

N70-11083# Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Braunschweig (West Germany). Inst. für Flugzeugbau.

BIBLIOGRAPHICAL DATA OF GERMAN AND FOREIGN LITERATURE IN THE FIELD OF ADHESIVE-BONDED METAL JOINTS (1966-1968) [AUSWERTUNG DER IN-UND AUSLAENDISCHEN LITERATUR AUF DEM GEBIETE DES METALLKLEBENS (1966-1968)]

Johanna Schlothauer Jul. 1969 61 p refs In GERMAN; ENGLISH summary

(DLR-MITT-69-10) Avail: CFSTI

This bibliography contains available German and English references in the field of adhesive-bonded metal joints during the period 1966-1968. Author (ESRO)

N70-11155 National Lending Library for Science and Technology, Boston Spa (England).

INFLAMMABILITY OF POWDERS OF THE ALUMINIUM-MAGNESIUM ALLOY SYSTEM [VOSPLAMENYAEMOST' POROSHKOV SPLAVOV SISTEMY ALUMINII-MAGNII]

V. G. Poyarkov Jul. 1969 9 p refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii, Tsvetn. Met. (Dzaudzhikau), no. 4, 1967 p 149-153

(NLL-RTS-5191) Avail: Natl. Lending Library, Boston Spa, Engl.: 12s 6d

The inflammability of aluminum magnesium alloy powders was studied by determining their self-ignition temperatures with a thermographic method. Data obtained for aluminum, magnesium, and their alloys with a content of 24.3 to 70.6 percent magnesium indicated that the temperature at the beginning of the endothermal effect coincided with the melting point of the alloy or metal of corresponding composition and that the ignition of the sample was preceded by melting of the metal or alloy inside the particles of the powder. The exception was magnesium powder where the ignition took place at a temperature of 579 deg, i.e. below the melting point. The self-ignition temperatures of the alloy powders were determined by the content of magnesium in the alloy; lowest self-ignition temperatures were recorded for an alloy with about 50 percent mg content. The presence of vapor mist in air noticeably decreased self-ignition temperatures of aluminum-magnesium alloy powders. G.G.

N70-11163# California Univ., Livermore. Lawrence Radiation Lab.

ELEVATED TEMPERATURE DEFORMATION AND ELECTRON MICROSCOPE STUDIES OF POLYCRYSTALLINE TUNGSTEN AND TUNGSTEN-RHENIUM ALLOYS

Richard R. Vandervoort and Willis L. Barmore 1 Oct. 1968 62 p refs Submitted for publication

(Contract W-7405-eng-48)

(UCRL-70524; CONF-680603-3) Avail: CFSTI

Tungsten, tungsten-25 wt percent rhenium and tungsten-30 wt percent rhenium were plastically deformed from 1400 deg to 1900 C at stresses up to 10,000 psi in a vacuum of less than 10 to the minus 8 torr. The activation energy for creep and the relationship between stress and strain rate were determined. Effects of thermomechanical history, composition, and grain size on strain rate were also investigated. Dislocation substructure was studied by etch pit and transmission electron microscope techniques, and these observations were correlated with the creep data. The factors important in the high temperature deformation of these materials were analyzed, and the experimental results were rationalized in terms of current theories for rate controlling deformation mechanisms. Author (NSA)

N70-11205# Argonne National Lab., Ill.

CORRELATED AND UNCORRELATED DIFFUSION VIA EDGE DISLOCATIONS [KORRELIERTE UND UNKORRELIERTE DIFFUSION UEBER STUFENVERSETZUNGEN]

H. Wever, P. Adam, and G. Frohberg Oct. 1968 13 p refs Transl. into ENGLISH from Acta Met. (London), v. 16, Oct. 1968 p 1289-1295

(ANL-Trans-683) Avail: CFSTI

Two distinct mechanisms must be considered in connection with an accelerated diffusion via edge dislocations in metals, an uncorrelated interstitial mechanism and a correlated vacancy mechanism. The proportion associated with the interstitial mechanism and the correlation factor for the vacancy mechanism are estimated. It is found that the interstitial mechanism can be important only for metals with a very high stacking fault energy. The correlation factor for the vacancy mechanism is an exponential function of the temperature and it follows that the activation energies generally differ for a correlated and uncorrelated transport via dislocation pipes; the difference is all the more pronounced, the more the accelerated diffusion is limited to the dislocation core. Author (NSA)

N70-11285# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.

A STUDY BY INTERNAL FRICTION OF DEFECTS PRODUCED IN IRON AND NICKEL IRRADIATED AT VERY LOW TEMPERATURES [ETUDE, AU MOYEN DU FROTTEMENT INTERNE, DES DEFAUTS CREES PAR IRRADIATION A TRES BASSE TEMPERATURE DANS LE FER ET LE NICKEL]

Gauthier de Keating-Hart (Ph.D. Thesis, 28 Jun. 1969) Jul. 1969 85 p refs In FRENCH; ENGLISH summary

(Contract DRME-GR-453)

(CEA-R-3757) Avail: CFSTI

This work represents a contribution to the study of point

defects in metals. After a brief review of the theory of internal friction technical innovations aimed at increasing the flexibility of the apparatus used are discussed. These innovations allow the extension of the range of measurements down to 20 K. Preliminary experiments on electron irradiated iron and the evidence for a laminar structure are described. An account of the first measurements on nickel after neutron irradiation at 27 K is also presented and the results are compared with those obtained by other methods in this laboratory. Transitory peaks at low temperature due to close Frenckel pairs have been observed and the absence of a peak which would correspond to the magnetic after effect band of stage I sub E has been noticed. An attempt is made to explain the disappearance of the observed peaks upon the application of an internal saturating magnetic field. Author (ESRO)

N70-11320# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
EROSION AND PROTECTION OF METALS, SECOND EDITION, 1966
L. A. Orvantsov et al Nov. 1968 28 p refs Transl. into ENGLISH from Russian book p 55–60, p 107–117
(Grant NSF-GK-1889)
(PB-184593T; Rept-01357-1-I) Avail: CFSTI CSCL 20D

Physics and instrumental equipment for studying cavitation erosion are discussed. Emphasis is placed on magneto-striction vibrators and the crystalline structural properties of their metal parts. G.G.

N70-11362# State Inst. for Technical Research, Helsinki (Finland).
PRECIPITATION DEOXIDATION IN STEEL [TERAEKSEN SAOSTUSDESOKSIDAATIO]
P. Asanti and Chr. Ottosson 1969 47 p refs In FINNISH; ENGLISH summary
Avail: CFSTI

For reducing the oxygen content of steel, i.e. for deoxidation, four alternative methods may be used: precipitation deoxidation, gas rinsing, vacuum treatment and fusion. The vacuum fusion method prevents dissolution of oxygen without actually being an oxygen-removing method. For the precipitation deoxidation easily oxidizing materials are used, such as Si, Al, Ti, etc. which have to be added to the steel in such a way, that they mix with it as well as possible. Then their effect extends over the entire batch being treated. In the stage of addition unnecessary contact with the air should be avoided in order to reduce combustion losses to a minimum. When the deoxidation element reacts with oxygen present, the amount of dissolved oxygen in the steel decreases, while oxygen is passing over to the slag inclusions of oxides. Author

N70-11370# British Iron and Steel Research Association, London (England). Metallurgy Div.
CRACK OPENING DISPLACEMENT INFERRED FROM PLASTICITY PHENOMENA
D. Elliott and M. J. May 1969 9 p
(PB-185434; MG/C/86/68) Avail: CFSTI CSCL 11F

The report describes a method of inferring crack opening displacement from the plastic component of strain of a load/displacement test record. The results have been obtained using Charpy-sized specimens containing fatigue cracks or machined slits with crack length to specimen width (a/W) ratios between 0.2 and 0.5 respectively. Comparison of the inferred values of C.O.D. with actual C.O.D. measurements determined optically shows extremely good agreement. Thus, the proposed method of inferring C.O.D. enables measurements to be readily obtained without the need of intricate measuring apparatus positioned at the crack tip. Author (USGRDR)

N70-11387# British Steel Corp., London (England). Inter-Group Labs.
CORRELATION OF SPRAY RING DATA FOR GAS ATOMISATION OF LIQUID METALS
H. Lubanska 1969 12 p refs
(PB-185432; P/2/69) Avail: CFSTI CSCL 11F

A comparison was made between the atomization characteristics of several liquid metals, gas-atomized by spray rings of various design. An approximate correlating equation is deduced for the particle mass median diameter, based on the available data from iron atomization trials and model experiments using tin and low melting point alloys. Author (USGRDR)

N70-11389# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF PLASTICITY AND THE DEVELOPMENT OF ADVANCED METHODS OF THE PRESSURE WORKING OF METALS IN USSR OVER 50 YEARS
V. S. Smirnov Mar. 1969 18 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii (Tomosk), v. 10, no. 10, 1967 p 44–50
(AD-689856; FTD-MT-24-414-68) Avail: CFSTI CSCL 11/6

Metal pressure working technology is reviewed. Rolling mills have been built for the production of ship sections, shapes, rails, sheets, tubes, etc. Combination processes such as the simultaneous application of rolling and welding, continuous casting and welding, bending and rolling, and casting and stamping are being used on an increasingly broader scale. Combination processes are also used in powder metallurgy. Author

N70-11395*# Techtran Corp., Glen Burnie, Md.
SINTERING AND HOT PRESSING OF MONOXIDE REFRACTORY COMPOUNDS, BORIDES, CARBIDES, NITRATES AND SILICIDES [LE FRITTAGE ET LA COMPRESSION A CHAUD DES COMPOSES REFRACTAIRES NON-OXYDES, BORURES, CHARBURES, NITRURES ET SILICIURES]
H. Pastor Washington NASA Oct. 1969 43 p refs Transl. into ENGLISH from L'Ind. Ceram. (France), no. 615, Feb. 1969 p 89–104
(Contract NASw-1695)
(NASA-TT-F-12474) Avail: CFSTI CSCL 11F

The shaping of refractory compounds is described. Hot pressing processes use pressures of several hundreds of bars at high temperatures and accelerating metals to produce the maximum increase in density of refractory nonoxide compounds. Sintering under very high pressures, allows preservation of initial particle size. The equipment used is described and illustrated. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N70-10026*# Dynatech Corp., Cambridge, Mass.
DEVELOPMENT OF NONFLAMMABLE PAPER CONSTRUCTIONS Final Report, 8 Nov. 1967–30 Apr. 1969
Glenn K. Armstrong 1 Jun. 1969 30 p refs
(Contract NAS9-7610)
(NASA-CR-101977; Rept-870) Avail: CFSTI CSCL 11B

Asbestos, microfiber glass, and beta glass additions were evaluated for their low flammability and modification properties in glass based sheet development. Results from a number of treatments on various substrates to evaluate possible new approaches to the manufacture of nonflammable paper are shown in table

form. The most significant observation found was the ability of phosphoric acid salts (diammonium phosphate) either alone or in combination with Fluorel to fireproof cellulose in the 6.2 psia O2 atmosphere. G.G.

N70-10028*# Grace (W. R.) and Co., Clarkesville, Md. Washington Research Center.
DEVELOPMENT OF INORGANIC NONFLAMMABLE VERMICULITE FLIGHT PAPER, PHASE 1, FEBRUARY - JULY 1968
E. W. Lard Jul. 1968 19 p
(Contract NAS9-7782)
(NASA-CR-106576) Avail: CFSTI CSCL 11G

An inorganic paper was developed from vermiculite plus chrysotile asbestos and Beta glass fibers which is nonflammable in 100% oxygen (16.5 psia), and accepts printing well by the offset process. Although not all properties of the new vermiculite flight paper are equivalent to those of bond paper, it is considered suitable for use in manned space flight missions. It is concluded that vermiculite flight paper can be used in its present form for flight manuals for manned Apollo flights. Author

N70-10031# Sandia Corp., Albuquerque, N.Mex.
AN EVALUATION OF GLASS AS A PASSIVE SHOCK PRESSURE GAGE MATERIAL
Gilbert L. Eggert Apr. 1969 14 p refs
(PB-184349; SC-TM-69-88) Avail: CFSTI CSCL 14B

Eight compositions of glasses were evaluated for application as the sensors in the construction of passive shock pressure gages. Although all of the glasses displayed irreversible densification under static loading, none densified sufficiently under shock loading to be considered for a passive pressure measurement sensor. Author (USGRDR)

N70-10141# North Dakota Univ., Grand Forks. Physics Dept.
RADIATION DAMAGE TO SILICA STRUCTURES Final Report
Harold D. Bale 15 Apr. 1969 18 p refs
(PB-183840; COO-1255-6) CSCL 20K

X-ray measurements have been made on neutron irradiated silica glass, silica gel and quartz. The surface area of the gels was found to decrease upon irradiation, the reduction being more rapid for the higher surface area gels. Silica glass samples irradiated with a relatively low neutron flux, 3.1 × 10 to the 18th power n sub (f/sq cm), showed a noticeable rise in the scattering at the smallest angles. This scattering was attributed to damaged regions having a radius of gyration of 40A. In addition, all irradiated silica glass samples showed a general increase in the scattering over the entire small angle region. This scattering, which showed no angular dependence, was attributed to increased density fluctuations within the sample after irradiation. Large angle x-ray measurements were carried out on both silica glass and quartz. The radial distribution curves obtained were in essential agreement with those of Simon. Double Bragg, scattering in the small angle region was observed in quartz samples irradiated with low neutron flux but not from quartz after prolonged irradiation. Author (USGRDR)

N70-10147# Naval Research Lab., Washington, D.C. Chemical Physics Lab.
SURFACE CHEMISTRY OF PLASTICS REINFORCED BY STRONG FIBERS
W. A. Zisman *In its* Rept. of NRL Progr. Sep. 1969 p 10-29 refs (See N70-10147 01-34)
Avail: CFSTI

A critical and up-to-date review was made on present knowledge of the surface chemistry and related polymer science involved in the reinforcement of thermosetting and thermoplastic materials by glass or other strong fibers. Although the emphasis is usually on the behavior of glass-reinforcing fibers and particles, wherever possible the discussion and conclusions are presented so as to allow their extension directly or by analogy to other strong reinforcing solids. A selected bibliography is given of the most significant scientific work published to date. The treatment of the subject is as fundamental as scope and reliability of available data permit. In many instances, available knowledge is interpreted by using the reviewer's judgment. Where significant gaps or conflicts are noted in the literature, they are discussed constructively. In the concluding sections numerous highly specific recommendations are made to stimulate or guide future research and development in this complex field. Author

N70-10281*# ITT Research Inst., Chicago, Ill.
CHARACTERIZATION OF CERAMIC MATERIALS FOR MICROELECTRONIC APPLICATIONS, PART 3 Final Summary Report, 13 Mar. 1968 - 12 Mar. 1969
A. J. Mountvala [1969] 57 p
(Contract NAS1-8025)
(NASA-CR-66817) Avail: CFSTI CSCL 11B

The major objectives of this investigation were to characterize surfaces and grain-boundaries in such electroceramic materials as BaTiO3. Dielectric measurements over a frequency range were used to characterize particulate BaTiO3 possessing known differences in stoichiometry and particle size. An electron beam scanning technique to study the electrical characteristics of ceramic grain-boundaries was developed, and results obtained with KCl and BaTiO3 described. Author

N70-10282*# Techtran Corp., Glen Burnie, Md.
THE IRRADIATION EFFECT ON CERAMIC MATERIALS
N. S. Kostyukov Washington, D.C. NASA Oct. 1969 21 p refs Transl. into ENGLISH from Zh. Vses. Khim. Obshchestve im. D. I. Mendeleeva, v. 13, no. 2, 1968 p 193-200
(Contract NASw-1695)
(NASA-TT-F-12651) Avail: CFSTI CSCL 11B

Investigations pertaining to the properties of ceramic materials employed as radiation resistant insulators in atomic energy applications are generalized. The effects of neutron irradiation on ceramic materials at various flux densities is investigated and radiation induced changes in the electrical and mechanical properties of ceramic materials are discussed. Author

N70-10378# McDonnell-Douglas Astronautics Co., Santa Monica, Calif.
DEVELOPMENT OF AN OPTIMUM NONCYLINDRICAL FIBERGLASS PRESSURE HULL FOR DEEP SUBMERGENCE, PHASE 2 Final Report
Herbert R. Jacobson Aug. 1969 120 p refs
(Contract NObs-94316)
(AD-691255; DAC-63268) Avail: CFSTI CSCL 11/4

The purpose of this program was to determine the optimum noncylindrical shape for use as a glass-reinforced-plastic deep-submergence pressure hull. Analytical parametric studies were performed to identify the pressure hull design concepts. Several lightweight configurations were identified. They included combinations of doubly curved hull shapes, such as spheres, prolate spheroids, and ogives. These configurations were analyzed using different laminate constructions and were designed for collapse depths of 20,000 and 40,000 feet. The hull design shape selected from those studies for manufacture is a unique composition of a series of intersecting spheres. Small-scale test models of this hull concept were designed and fabricated using shingle winding methods and collimated pre-preg tape. Two configurations were manufactured; these were: (1) the basic hull section consisting of linked spheres and supporting ribs with plug ends, and (2) complete hull specimens of the basic hull section with end joint structure and titanium endomes. Hydrostatic tests of these specimens were run. Strain gage readings showed 1 to 1 stress fields in the spherical sections.

thus validating the basic concept. However, the specimens had premature failures. These failures were traced to small local areas of wavinesses in the longitudinal fibers over the ribs in otherwise sound layups. Author (TAB)

N70-10416# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
EFFECT OF ENVIRONMENTAL FACTORS ON COMPOSITE MATERIALS Technical Report, Aug. – Dec. 1967
J. C. Halpin Jun. 1969 64 p refs
(AD-692481; AFML-TR-67-423) Avail: CFSTI CSCL 11/4

Some of the environmental factors which affect the structural performance of composite materials are discussed. Various possible mechanisms of environmental factors are examined, together with relevant experimental data. Finally, an analytical approach for predicting environmental effects, based on rate theory, is considered. Author (TAB)

N70-10458# Naval Ordnance Lab., White Oak, Md.
ACOUSTIC PROPERTIES OF POLYETHYLENE NEAR THE MELTING POINT Interim Report
Bruce Hartmann and Jacek Jarzynski 4 Jun. 1969 39 p refs
(AD-692377; NOLTR-69-83) Avail: CFSTI CSCL 11/9

Ultrasonic absorption and velocity measurements were made on high density polyethylene to above the melting point. The measurements were done at 53 kHz and showed a maximum in absorption in excess of 10 db/cm above the room temperature absorption. A simple two state theoretical model (crystalline and amorphous) correctly predicted the shape of the absorption curve but not the magnitude of the peak. Author (TAB)

N70-10570 Akron Univ., Ohio.
LARGE DEFORMATIONS OF HOLLOW RUBBER UNITS
Jean-Michel Charrier (Ph.D. Thesis) 1968 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-17861

The elastic behavior of rubber for large deformations can be calculated according to several treatments. Two of them have been selected here for theoretical considerations: the simplest (Neo-Hookean) and a more complicated and also more accurate one (Gent-Thomas). In Part A, the deformation of a variety of shells under inflation has been studied. A non-homogeneous deformation referred to as bulging or instability received special attention. In Part B, the inflation of a thin tube between two parallel plates with or without friction on the plates has been investigated theoretically and experimentally with success. This study shows the ability of large deformation elastic theories to give reasonable predictions which can be useful for practical applications. Dissert. Abstr.

N70-10629# Army Foreign Science and Technology Center, Washington, D.C.
POLYORGANOSILOXANES AS ANTIMICROBIAL COMPONENTS OF HYDROCARBON LUBRICANTS
G. P. Grigoryeva et al 1969 10 p refs Transl. into ENGLISH from Chem. and Technol. of Fuels and Oils, no. 2, 1969 p 22–23
(AD-692534; FSTC-HT-23-341-69) Avail: CFSTI CSCL 11/8

The susceptibility of various Soviet and foreign cable lubricants to contamination by microorganisms was studied. The comparative resistance of individual components of hydrocarbon cable lubricants to microflora was evaluated. It was shown that polyethylsiloxane liquids numbers 4 and 5 have absolute resistance, and they are recommended as components of lubricants intended for use in tropical conditions. Author (TAB)

N70-10634# Army Foreign Science and Technology Center, Washington, D.C.
IMPARTING ANTIMICROBIAL PROPERTIES TO FIBERS
L. A. Volf 1969 10 p refs Transl. into ENGLISH from Tekstil. Prom. (Moscow), no. 8, 1965 p 9–11
(AD-691986; FSTC-HT-23-060-69) Avail: CFSTI CSCL 11/5

A brief review is given of existing methods for imparting antimicrobial properties to fibers and fabrics. The salient features of the methods, their advantages and disadvantages, and the properties of the resulting antimicrobial fibers are described. Author (TAB)

N70-10666# American Optical Co., Southbridge, Mass. Central Research Lab.
PREPARATION OF PLATINUM FREE LASER GLASS Final Report, 1 Aug. 1964 – 28 Feb. 1967
Richard F. Woodcock Aug. 1969 57 p refs
(Contract NONR-4656(00))
(AD-692504; Rept-571-F) Avail: CFSTI CSCL 11/2

The problem of platinum inclusions in laser glass was investigated by two separate approaches simultaneously; namely, the improvement of platinum lined melters and the development of an all-ceramic melter. In the former, the major cause of platinum inclusions was identified as the formation of platinum oxide at elevated temperatures and its subsequent vaporization and deposition on exposed molten glass surfaces. This was largely eliminated with the use of inert atmospheres. The inert atmosphere introduces the possibility of direct interaction between the glass and platinum which was investigated but not completely resolved. A 50-lb capacity, platinum lined, inert atmosphere furnace producing glass of good optical quality is now in operation. In the all-ceramic melter approach, evaluation of existing ceramic materials led to the design and construction of a bottom-casting system fabricated from a high purity mullite material. This furnace, also of 50-lb capacity, is now in operation. Several modifications were made to improve the optical quality of the glass produced. Melts to date, have been designed to investigate the stirring parameters of the system. The resulting glass contains varying degrees of striae but exhibits excellent absorption characteristics, equal to that produced in a platinum crucible indicating that the high purity mullite is not a source of iron contamination. Author (TAB)

N70-10717# Triplex Safety Glass Co., Ltd., London (England).
THE REPEATABILITY OF STRENGTH OF TOUGHENED AND STRENGTHENED CLEAR WHITE PLATE GLASSES
Min. of Technol. Apr. 1969 6 p Previously D. Mat-110
(Contract NU/B/170/GS.3(a))
(D-MAT-110-Rev) Avail: CFSTI

At the time this work was carried out a large number of modifications to the toughening furnace had been carried out and a simple assessment was necessary of the variability which might be expected with toughened glasses processed in that furnace. For this assessment 300 specimens of clear white plate glass were toughened in six separate batches, the processing of the batches being about 3 day intervals so that fresh setting up of the furnace was involved each time. Modules of rupture determinations were carried out on the toughened specimens and an overall coefficient of variation of 6.9% was considerably lower than that obtained in earlier work. A similar study was carried out for strengthened glass. For both toughened and strengthened glass the batch to batch repeatability was rather low and a recommendation was made that efforts should be made to improve this. Author (ESRO)

N70-10788# Scientific Translation Service, Ann Arbor, Mich.
CERAMIC MATERIALS OF HIGH MECHANICAL STRENGTH FOR HIGH TENSION INSULATORS
Kazimierz Cyarnowicz 15 Aug. 1969 35 p refs Transl. into ENGLISH from Szkło Ceram. (Warsaw), v. 13, no. 12, 1962 p 374–386 Sponsored by AEC
(PB-185361T; ONRL-TR-2188) Avail: CFSTI CSCL 11B

Experiments and tests were carried out which confirmed the feasibility of improving the mechanical strength of porcelain

bodies by about 50% compared to the strength of bodies produced to date. This considerable improvement was obtained by enriching the bodies with aluminum oxide. USGRDR

N70-10762# IIT Research Inst., Chicago, Ill.
STRUCTURAL CERAMIC COMPOSITE SYSTEMS Final Report
S. A. Bortz 23 Jul. 1969 73 p refs
(Contract N00014-66-C-0186)
(AD-692149) Avail: CFSTI CSCL 11/4

The program was directed toward obtaining a better understanding of metal fiber-reinforced ceramics which would ultimately enable prediction of ceramic composite properties from composite theory. Experiments were designed to study the effect of mechanical and chemical bond between reinforcement and matrix on composite strength. Basic data were obtained from pull-out tests and wetting studies. Author (TAB)

N70-10767# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.
LARGE DEFORMATIONS OF A LAMINATED COMPOSITE
R. A. Grot and J. D. Achenback Jul. 1969 37 p refs
(Contract Nonr-1228)34))
(AD-692417; TR-69-2) Avail: CFSTI CSCL 11/4

An approximate nonlinear theory is derived to describe the mechanical behavior of a laminated composite consisting of alternating layers of two homogeneous materials subjected to large deformations. The theory is based on two-term expansions of the motion across the thicknesses of the undeformed layers. The kinematics and the balance laws are formulated, and the constitutive equations are worked out for elastic behavior of the constitutive materials. The governing equations are subsequently written out in detail for the case of a small amplitude disturbance superimposed on a large static deformation. The latter system of equations is used to investigate the propagation of small amplitude time-harmonic waves in a prestressed laminated composite. Author (TAB)

N70-10770# National Engineering Lab., Glasgow (Scotland). Materials Group.
APPLICATION OF GRIDS TO PLASTICS FOR THE MOIRE FRINGE METHOD OF STRAIN MEASUREMENT
J. S. Strannigan and J. McGregor Oct. 1968 14 p refs
(NEL-365) Avail: Issuing Activity

There has been considerable interest during recent years on the measurement of strain using the Moiré fringe method. This report reviews the techniques of applying grids to specimens and gives details of methods used. Strain measurements on a simple tensile test specimen using the Moiré mismatch technique were compared with those obtained with a Linley extensometer. Author

N70-10774*# Texas Univ., Austin. Electrical Materials Research Lab.
RESEARCH ON DIGITAL TRANSDUCER PRINCIPLES. VOLUME 8: ELECTRICAL CONDUCTION MECHANISMS IN METAL-SEMICONDUCTOR-POLYMER THIN FILM STRUCTURES, 1 JULY–30 JUNE 1968
Lieh Chun Wang and William H. Hartwig 30 Jun. 1968 67 p refs
(Grant NGR-44-012-043)
(NASA-CR-106580) Avail: CFSTI

Electron conduction mechanisms of metal–polymer–semiconductor systems were investigated. Poole–Frenkel effects have been observed as the dominating conduction mechanism of the polymer. However, the I–V characteristics of MPS devices are different in the forward and reverse bias conditions. In forward direction, the current is dominated by the field within the polymer and increases exponentially with bias voltage in the fashion of Poole–Frenkel effect. In the reverse direction, three distinguishable regions may be obtained for the I–V characteristics on a ln J vs V plot. These were interpreted in terms of the proportion of voltage drops across the polymer and semiconductor to the total bias voltages. The generation of electron–hole pairs in the depletion layer of the semiconductor limits the current flow in the reverse bias condition and current saturation may be observed. The I–V characteristics of MPS devices were found extremely sensitive to silicon surface preparation. Strong chemical etching was preferred for observing current saturations. Author

N70-10795# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Flugzeugbau.
PLASTIC COMPOSITE MATERIALS AND DESIGN PRINCIPLES FOR THE PRODUCTION OF GAS TURBINE BLADES [KUNSTSTOFF-VERBUNDWERKSTOFFE UND BAUWEISEN ZUR HERSTELLUNG VON GASTURBINENSCHAUFELN]
Guenter Niederstadt and Martin Welz Mar. 1969 59 p In GERMAN; ENGLISH summary
(Contract TO1-512-J-205/2)
(DLR-MITT-69-09) Avail: CFSTI

For some years glass fiber reinforced plastics have been used for the construction of cool stage compressor blades. For their application to turbine blades the plastics were not sufficiently heat-resistent. The development of new plastics based on polyamides and poly-benzimidazols in America lead to new application. In this report five other resins are tested with regard to their use in turbine blades in the hotter stages of the compressor. In addition to the mechanical properties between 20 deg and 500 deg C the stability in boiling distilled water, adhesive strength, vaporisation time and temperature are measured. The results show that resins exist which can endure temperatures up to 400 C, but the manufacturing of these resins is rather difficult. In the second part of this report, the development of a three-part blade is described. Experiments with different blade-attachments were successfully concluded. Author (ESRO)

N70-10828# Commissariat a l'Energie Atomique, Limeil (France).
CONTRIBUTION TO THE STUDY OF STIMULATED EMISSION IN NEODYMIUM-DOPED GLASS [CONTRIBUTION A L'ETUDE DE L'EMISSION STIMULEE DANS LE VERRE DOPE AU NEODYME]
Jean-Michel Jego (Ph.D. Thesis–Rennes Univ., 12 Dec. 1968) Jul. 1969 92 p refs In FRENCH; ENGLISH summary
(CEA-R-3719) Avail: CFSTI

The stimulated emission of electro-magnetic waves by atoms is caused by the presence of radiating energy of suitable frequency in a material in a non-equilibrium state and this discovery led to the fabrication of generators and wave amplifiers for very short, almost monochromatic wavelengths. In the first optical laser the active atom was chromium situated in an alumina matrix (ruby). The fluorescent single crystal was placed between two reflectors which maintained in the medium a provoked inversion of the population until the emission conditions were attained. The laser effect has made it possible to produce several hundred line generators covering the optical range for both gaseous and liquid or solid media. Amongst the latter, neodymium has a transition between the 4 F sub 3/2 and the 4 I sub 11/2 levels which has made it possible to obtain very high power lasers. A study has been made of the conditions in which a pulse can be formed, and its amplification in neodymium-doped glass. By making accurate measurements of the various yields involved in this process, it has been possible to obtain the value for the population inversion obtained in the medium, and to make a detailed study of stimulated emission in neodymium. Author (ESRO)

N70-10869# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
NEUTRON DIFFRACTION STUDY AT 0.3 K OF THE MAGNETIC PROPERTIES OF RARE-EARTH ALUMINUM OR GALLIUM GARNETS [ETUDE PAR DIFFRACTION DES

NEUTRONS A 0.3 K DES PROPRIETES MAGNETIQUES DE GRENATS DE TERRE RARE ET D'ALUMINIUM OU DE GALLIUM]

Jacques Hammann (Ph.D. Thesis--Paris Univ., 27 Mar. 1969) Jul. 1969 151 p refs In FRENCH; ENGLISH summary
(CEA-R-3866) Avail: CFSTI

To study ordered magnetic states below 1.5 K by neutron diffraction measurements, a helium-3 cryostat was built in which a large sample of powder was heated by a helium 4 superfluid film. This left the possibility of applying an external magnetic field and essentially the magnetic phase transitions of rare-earth aluminum or gallium garnets were studied. The antiferromagnetic structures of erbium gallium garnet (T sub N = 0.79 K) and neodynium gallium garnet (T sub N = 0.516 K) were first determined. The metamagnetic behavior of erbium gallium garnet was observed and compared to that of the dysprosium aluminum garnet. Then the 'non-Kramers' ions Tb(3+) and Ho(3+) in the aluminum garnets were studied. In this case only two single ground states (well isolated from upper levels) needed to be considered. A molecular field model with purely magnetic dipolar interactions lead then to the existence of magnetic phase transitions with antiferromagnetic ordering. This was observed for the terbium-aluminum garnet below T sub N = 1.35 K and for the holmium-aluminum garnet below T sub N = 0.98 K. Author (ESRO)

N70-10906*# Republic Aviation Corp., Farmingdale, N.Y.
DEVELOPMENT OF HIGH TEMPERATURE POLYIMIDE ROD SEALS Final Report

J. Lee 21 Aug. 1969 118 p refs
(Contract NAS3-11170)
(NASA-CR-72563; FHR-3612-1) Avail: CFSTI, CSCL 11A

A polyimide V-seal was redesigned to improve the seal's fatigue life and to provide a more efficient and controllable loading of the seal. Two redesigned versions of the original seal were tested in conjunction with a spring-loaded lip seal using the original V-seal as the control specimen. Both of the improved V-seal configurations demonstrated exceptionally good sealing performance in meeting the program objective of 20 million short-stroke cycles of operation at 500 F (260 C). The original V-seal design failed after approximately 11 million cycles, which was approximately the operating life obtained in previous testing. The spring-loaded lip seal developed excessive leakage after 3.3 million cycles due to shrinkage of the polyimide material. Results obtained on the modified V-seals demonstrated the validity of the techniques used to improve the performance of the seals. Author

N70-10963*# City Coll. Research Foundation, New York.
FUNDAMENTALS OF THE OXIDATION PROTECTION OF COLUMBIUM AND TANTALUM Semiannual Report, 1 Apr.--1 Oct. 1969

Morris Kolodney and Robert A. Graff 1 Oct. 1969 20 p refs
(Grant NGR-33-013-017)
(NASA-CR-106738; SAR-6) Avail: CFSTI CSCL 11C

An investigation of the fundamental processes involved in the protection of tantalum and columbium by their silicides is in progress. The program has three parts. The first part was devoted to establishing thermochemical data for the silicides and employed an entirely solid state electrochemical cell. The free energies of formation of the tantalum silicides were determined and reported. The second part deals with the protection of both coating and substrate by the protective glass formed during oxidation. Under certain conditions of temperature and pressure this glass does not form and the coating fails. The study of glass structure and growth is aimed at understanding the causes of failure and providing a rational basis for improving coatings. Lastly, since coating life may be limited by the formation of intermediate phases between the silicide and the substrate, these interactions were investigated along with the efficacy of diffusion barriers to retard intermediate phase growth. Author

N70-11064*# Rocketdyne, Canoga Park, Calif.
INVESTIGATION OF POSITIVE TYPE SHAFT SEALS Final Report

14 Nov. 1969 55 p refs
(Contract NAS8-11325)
(NASA-CR-106715; R-7988) Avail: CFSTI CSCL 11A

The effect on seal leakage of surface finish, face load, leakage pressure, temperature, and sealed fluid were investigated. The fluids were gaseous helium, liquid hydrogen, and water. Results of a test program conducted for the investigation are presented, and a literature survey is included. Author

N70-11073*# Uniroyal, Inc., Mishawaka, Ind. Engineered Systems Dept.
EXPERIMENTAL AND THEORETICAL STUDY FOR DEVELOPMENT OF AN IMPROVED REINFORCED FLEXIBLE WINDOW Final Report, 19 Dec. 1967--11 Jul. 1969

Don E. Hile, Jr. 11 Jul. 1969 90 p
(Contract NAS1-7771)
(NASA-CR-66823) Avail: CFSTI CSCL 11D

A window composite was developed which exhibits superior properties in comparison to earlier constructions. The window construction consists of silicone encapsulated polyether urethane matrix reinforced with a carbon steel rocket cable pattern. The composite exhibits excellent flexibility with an overall thickness of 2.54 mm, pressure resistance to 24.30 nscm, heat resistance of 150 C for 24 hours, and excellent optical transparency. Author

N70-11107*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PREPARATION AND PROPERTIES OF IMIDE/PYRRONE COPOLYMERS

Vernon L. Bell Washington Nov. 1969 24 p refs
(NASA-TN-D-5559; L-6049) Avail: CFSTI CSCL 11I

Two series of copolymers containing imidazopyrrolone (Pyrrone) and imide groups were prepared by solution polymerization. The mechanical properties of thin films of the copolymers were measured and the films showed a general increase in the tangent modulus and a decrease in elongation with increasing Pyrrone content. The copolymers were more resistant to degradation by strong acids and bases than the corresponding polyimide. The thermal stabilities of the copolymers in air improved with increasing imide content, while the thermal stabilities in a vacuum improved with increasing Pyrrone content. These copolymers represent a way to utilize the useful properties of each class of homopolymers. Author

N70-11113# Lockheed Missiles and Space Co., Palo Alto, Calif. Materials Sciences Lab.
SPACE MATERIALS HANDBOOK Technical Report, Jun. 1967--Jun. 1968

John R. Rittenhouse and John B. Singletary Wright-Patterson AFB, Ohio USAF Jul. 1968 747 p refs Revised
(Contract F33615-67-C-1739)
(AD-692353; REV-3; AFML-TR-68-205) Avail: CFSTI CSCL 11/7

The edition is the result of an extensive revision and reworking of the second edition of the Space Materials Handbook along with the incorporation of entirely new subject matter coverage and new materials data. All of the most significant material, phenomena, properties, and principles covered in the original Handbook are presented and expanded in this revised and updated version. However, treatment of theoretical aspects has been condensed in order that more emphasis could be placed on the extensive new materials knowledge and data obtained from the design and successful launching of a wide variety of space systems. The handbook is organized into four parts, namely: space environment, effect of space environment on materials, materials in space, and biological interaction with spacecraft materials. Information on mechanical, physical, and chemical properties and characteristics is given for a wide variety of metallic and nonmetallic materials. The

effects of natural and induced environments on materials are appraised. Materials categories include coverage of thermal control materials, optical materials, adhesives, organic structural materials, inorganic structural materials, electronic components and materials, materials for sealing applications, and lubrication materials. In addition, a comprehensive multiple citation index is incorporated which gives ready access to information on specific subject areas with regard to their locations within the Handbook. Author (TAB)

N70-11137# British Shipbuilding Research Association, London (England).
PERMEATION OF LIQUID WATER THROUGH SWOLLEN PIGMENTED PAINT FILMS
A. Hilt and W. Funke 1968 10 p refs Transl. into ENGLISH from German Document
(Trans-2970) Avail: CFSTI; UK £5

The penetration of liquid water through paint films in the fully swollen state was studied by the radioactive tracer method. Tritium-labelled water was used as radioactive indicator. The results obtained by this method were compared with the values from the Payne-cup Method, where films are only partly swollen, and with properties of paints, involved with permeation, such as the absorption of water. The determination of the permeability of paint films in evenly swollen states frequently corresponds more to practical applications than the determination of permeability by Payne-cups. Author

N70-11140# European Space Research and Technology Center, Noordwijk (Netherlands).
RADIATION EFFECTS ON MATERIALS IN SPACE [ACTION DES RADIATIONS SUR LES MATERIAUX DANS L'ENVIRONNEMENT SPATIAL]
J. Dauphin *In* ESRO Proc. of the 6th ESRO Summer School, Vol. 4: Environ. and their Role in Spacecraft Technol.: Radiation Effects Feb. 1969 p 49–96 480 refs In FRENCH (See N70-11138 01-09)
Avail: CFSTI

Characteristics of radiation in the near earth environment are considered and the problems encountered because of this radiation reviewed. A theoretical study of interactions between radiation and matter is presented. The various ways in which their energy is absorbed in matter are discussed with some examples showing the difficulties encountered when using radiation sensitive components for space missions. Methods for shielding and ground simulation of radiation are discussed. ESRO

N70-11145# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF DEALING WITH FIRES AND EASILY INFLAMMABLE LIQUIDS THROUGH THE USE OF FOAMS
S. K. Vygovskii et al 10 Jun. 1969 5 p Transl. into ENGLISH from Russian Patent no. 186864 (Appl. no. 941750/23-26, 10 Feb. 1965) 1 p
(AD-692502; FTD-HT-23-134-69) Avail: CFSTI CSCL 13/12

Fire extinguishing foams of greater stability are generated more efficiently by using 3 percent aqueous solution of the vat residues which are formed in the course of the production of 100 percent isobutylene and which contain surfactants. Such solutions have better storage stability and foaming activity than the usual extinguishers based on surfactants. Author (TAB)

N70-11189# Royal Aircraft Establishment, Farnborough (England).
A MERCURY VAPORISER TEMPERATURE CONTROLLER FOR AN ION ENGINE
B. A. Knight Dec. 1968 10 p refs
(RAE-TR-68292) Avail: CFSTI

A system is described which enables the temperature of a mercury vaporiser to be maintained within tor-0.25 C of a present value, within the range of 210 C to 260 C. For laboratory use the temperature sensor takes the form of a copper/constantan thermocouple, the amplified output of which controls the duty cycle of an astable circuit. This device is used to operate power switches, or an inverter, to drive current through the heating element of the vaporiser. For use in space an alternative system with a platinum resistance thermometer as a sensor is also described. Author (ESRO)

N70-11222# Akron Univ., Ohio.
MECHANICS OF VISCOELASTICS COMPOSITES, PART 2 Final Report, 1 Mar. 1968–28 Feb. 1969
A. N. Gent, N. C. Hilyard, and S. V. Kanakkanatt May 1969 53 p refs
(Contract F33615-67-C-1393)
(AD-690612; AFML-TR-68-152-Pt-2) Avail: CFSTI CSCL 11/10 An apparatus was developed to measure the dynamic mechanical properties of foamed materials filled with a viscous fluid, over a frequency range from 0.002 to 200 Hz. It has been tested using two model viscoelastic materials over the temperature range -50C to +100C. Measurements were then made on various foam/fluid systems including rubber latex, polyether and polyester foams filled with air, glycerin, silicone oil and water. The Gent-Rusch theory has been modified to take into account inertia effects, damping in the matrix material itself, and special features of the test-piece assembly. The modified theory is shown to describe the measurements successfully over the entire frequency range employed. Stress-optical coefficients have been determined for lightly-cross-linked samples of cis- and trans-polyisoprene, swollen to a high degree in a variety of non-polar solvents. A strong dependence on the geometrical asymmetry of the solvent molecule has been observed. Solvents with long straight molecules gave large values of the stress-optical coefficient whereas those with compact symmetrical molecules gave minimum values. This effect is attributed to short-range orientational order, due to packing effects in a molecularly-anisotropic medium. Author (TAB)

N70-11226*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
PROCESS FOR MAKING EPITAXIAL GERMANIUM FILMS Patent Application
Robert F. Adamsky, inventor (to NASA) and William T. Brogan, inventor (to NASA) Filed 11 Aug. 1969 8 p
(NASA-Case-ERC-10234; US-Patent-Appl-SN-848803) Avail: CFSTI CSCL 11C

A germanium substrate is placed in a vacuum chamber in which the background pressure is in the 10 to the minus 10th power to 10 to the minus 8th power torr range. The germanium substrate is preheated to a temperature of 600 C or higher for three to five minutes or longer. After the preheat period the temperature of the substrate is reduced to approximately 100 C and germanium is evaporated on the substrate with the substrate held at the temperature of approximately 100 C. NASA

N70-11322 National Lending Library for Science and Technology, Boston Spa (England).
SUSCEPTABILITY OF SYNTHETIC MATERIALS USED FOR CLOTHING TO ELECTROSTATIC CHARGING [OB ELEKTRIZUEMOSTI SINTETICHESKIKH MATERIALOV, PRIMENYAEMIKH DLYA ODEZHDI]
A. I. Merkulova Aug. 1969 7 p refs Transl. into ENGLISH from Tekstilna Prom. (Sofia), v. 28, no. 10, 1968 p 19–21
(NLL-RTS-5229) Avail: Natl. Lending Library, Boston Spa, Engl., 7s 6d

Electrostatic properties of synthetic materials used for clothing were studied for their implied hygienic effects on man. Results obtained showed that in contact with the skin all natural and polyamide materials acquired positive charge, thus subjecting the body to the influence of negative electrostatic fields; all synthetic materials, with the exception of polyamides, assumed a negative charge and subjected the body to a positive electrostatic field. A

table is included which shows which charge was acquired by a material of the electrostatic series when rubbed against a contact material. G.G.

N70-11362*# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF THE KINETICS OF CRYSTALLIZATION OF MOLTEN BINARY AND TERNARY OXIDE SYSTEMS Quarterly Status Report, 1 Jul.–30 Sep. 1969
James F. Bacon 1 Nov. 1969 62 p refs
(Contract NASw-1301)
(NASA-CR-106716; QSR-16; H910373-16) Avail: CFSTI CSCL 11B

New glass compositions were prepared in bulk form. Of these, a total of a dozen glass compositions have values for Youngs modulus measured on bulk specimens greater than 20 million pounds per square inch and another dozen have values between 19 and 20 million pounds per square inch. Of the glasses, eighty-seven were fiberized to some degree on a laboratory basis, although this does not necessarily imply that they are fiberizable on a commercial scale. The best of the glass fibers has a Young's modulus of 19.8 million pounds per square inch. Another fiber has a Young's modulus evaluated on the fiber of 18.6 million pounds per square inch and was prepared in quantity as a monofilament. This glass fiber was also incorporated both into an epoxy matrix and into a polyimide matrix. The epoxy resin composite shows a modulus forty percent better than that achievable using the more common grade of competitive glass fiber, and twenty percent better than that obtainable with the best available grade of competitive glass fiber. Author

N70-11385# Sandia Corp., Albuquerque, N. Mex.
MECHANICS AND PROPERTIES OF STRUCTURAL FOAMS
R. K. Traeger and R. D. Hermansen Aug. 1969 30 p refs
(PB-185360; SC-DC-69-1052) Avail: CFSTI CSCL 13C

Contents: Structural foams; What is a structural foam; Why foams for structures; Structural design needs; Present status; Mechanical properties data; Failure criteria. USGRDR

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N70-10038# Vanderbilt Univ., Nashville, Tenn.
ALGEBRAS SATISFYING THE DESCENDING CHAIN CONDITION FOR SUBALGEBRAS
Thomas P. Whaley (Ph.D. Thesis) 1968 53 p refs
(Grant NSF GP-7252)
(PB-184283) Avail: CFSTI CSCL 12A

Certain questions concerning the subalgebra structure of infinite algebras are considered. USGRDR

N70-10039# Vanderbilt Univ., Nashville, Tenn.
ON A THEOREM OF CUTLER
Charles K. Megibben 1968 4 p refs
(Grant NSF GP-7252)
(PB-184284) Avail: CFSTI CSCL 12A

The report presents a simple proof of a theorem by Cutler concerning Abelian groups. USGRDR

N70-10040# Vanderbilt Univ., Nashville, Tenn.
THE GENERALIZED KULIKOV CRITERION
Charles Megibben 1968 25 p refs
(Grant NSF GP-7252)
(PB-184285) Avail: CFSTI CSCL 12A

In 1941, Kulikov showed that a p-primary abelian group G is a direct sum of cyclic groups if and only if G is the union of an ascending sequence of subgroups each of which has a finite bound on the heights of its elements. The purpose of this paper is to establish a generalization of the Kulikov criterion for direct sums of countable reduced p-groups. USGRDR

N70-10041# Columbia Univ., New York. Dept. of Mathematics.
FORMAL FUNCTIONS AND FORMAL IMBEDDINGS
Heisuke Hironaka and Hideyuki Matsumura 1968 59 p refs
(Grant NSF GP-5177)
(PB-184286) Avail: CFSTI CSCL 12A

The work contains two theorems, among others, which determine the field of formal-rational functions, along a closed algebraic set X in a projective space P and in an abelian variety A, respectively. AUTHOR (USGRDR)

N70-10048# Vanderbilt Univ., Nashville, Tenn.
A GENERALIZATION OF THE CLASSICAL THEORY OF PRIMARY GROUPS
Charles Megibben 1968 8 p refs
(Grant NSF GP-7252)
(PB-184287) Avail: CFSTI CSCL 12A

A theory is given that generalizes those familiar results about primary abelian groups that depend on the notions of purity, basic subgroups, pure-projectivity and pure-injectivity. Author (USGRDR)

N70-10084# Wisconsin Univ., Madison Theoretical Chemistry Inst.
SOLUTION OF THE N-REPRESENTABILITY PROBLEM: SECOND ORDER DENSITY MATRICES OF FINITE RANK
Mary Beth Ruskai 27 Nov. 1968 45 p refs
(PB-183754; WIS-TCI-329) Avail: CFSTI CSCL 07D

The N-representability problem is approached by considering geminal product expansions symmetric and antisymmetric functions. Necessary and sufficient conditions for N-representability of second order density matrices of finite rank are obtained. These conditions can be extended to give a solution to the N-representability problem for higher order density matrices. The circumstances under which a density matrix can be derived from two or more different functions are considered. Author (USGRDR)

N70-10104 California Univ., Los Angeles.
METHOD OF CONJUGATE GRADIENTS FOR OPTIMAL CONTROL PROBLEMS WITH STATE VARIABLE CONSTRAINT
Thomas Shu Fong (Ph.D. Thesis) 1968 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-8097

A review of the computational method of conjugate gradients for linear and nonlinear operator equations is given with emphasis in applying this technique to state variable constraint control problems. The first and second Frechet derivatives of the performance functional are derived. The search directions generated in the iteration process for the optimal control are locally conjugate with respect to the second Frechet derivative. The convergence is along the expanding sequence of sets, the intersections of the linear spaces spanned by the search directions and the set of admissible controls. The computational aspect of this class of control problems is discussed in detail. This computational technique is applied to two state variable constraint problems, in one of which a penalty function is employed to convert the constraint problem to an unconstrained one in addition to the approach considering the constraints directly. For this same problem the method of steepest descent also is studied, and comparison of the results obtained is made and discussed. Dissert. Abstr.

N70-10142# Michigan State Univ., East Lansing. Statistics and Probability Dept.
ON THE HELLINGER INTEGRALS AND INTERPOLATION OF Q-VARIATE STATIONARY STOCHASTIC PROCESSES
Habib Salehi Oct. 1968 11 p refs
(Grant NSF GP-8614)

(PB-183996; RM-219) Avail: CFSTI CSCL 12A

The importance of the Hellinger integrals with regard to the theory of interpolation of a q-variate weakly stationary SP with discrete time has been discussed previously by the author. In this paper the Hellinger integrals are used to obtain similar results concerning the interpolability of a q-variate continuous parameter, mean continuous, weakly stationary SP. Author (USGRDR)

N70-10190 Purdue Univ., Lafayette, Ind.
ON THE STOCHASTIC FUEL-REGULATOR PROBLEM
Harold Dean Gilbert (Ph.D. Thesis) 1968 95 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-7445

The emphasis is upon practical reliazability of the resulting controllers. Sufficient conditions for optimality, which indicate that the optimal control is a deadzone function of the sufficient coordinates, are derived. To achieve the physically realizability requirement, a specific optimal controller, retaining the form of the deadzone control function, is introduced; and an on-line self-organizing control strategy is proposed that converges, in rth mean, to the specific optimal controller for a subclass of the linear, stochastic fuel regulator problem. The self-organization is achieved by an adaptive random strategy that includes (1) a subgoal which converges to the performance index, and (2) a global search algorithm which provides the overall convergence properties. The formulation, also, considers the effect of unknown random switching delays in the controller; and a feasibility study is included to demonstrate the practical aspects of the proposed control strategy. Dissert. Abstr.

N70-10197# New Mexico Univ., Albuquerque. Mathematics and Statistics Dept.
BAYES SEQUENTIAL DESIGNS OF FIXED SIZE SAMPLES FROM FINITE POPULATIONS
S. Zacks Oct. 1968 19 p refs
(Contract NSF GP-9007)
(PB-183938; TR-1) Avail: CFSTI CSCL 12A

The nonrandomized nature of Bayes designs is substantiated. The problem of choosing the inclusion probabilities of each unit in the population in a framework of Bayes sequential selection problem is formalized and it is proved that for any loss function (satisfying the required integrability conditions) and for any prior distribution, the Bayes selection strategy is a non-randomized one. The dynamic programming recursion relations by which the optimal selection scheme can be determined are shown. To illustrate various possible optimal designs for Bayes models, an example with two Bayesian models is given. One model yields an optimal design which is a single-phase one with particular choice of units. The second model illustrates a case in which the optimal selection of units is purely sequential. Author (USGRDR)

N70-10296# System Development Corp., Santa Monica, Calif.
AN UPPER BOUND FOR THE QUEUEING RECYCLE SUPPLY PROBLEM
Ronald Alter 10 Jan. 1969 19 p refs
(PB-184363; SDC-SP-3280) Avail: CFSTI CSCL 15E

The queueing recycle supply problem is first defined. Then, by concentrating on the recycle supply aspect of the problem, an algorithm is derived which guarantees a good upper bound on the optimal solution. Also, a practical problem is solved using the methods of the paper. Author (USGRDR)

N70-10298# California Univ., Berkeley. Operations Research Center.
OPTIMIZATION TECHNIQUES FOR OPTIMAL CONTROL SYSTEMS WITH STATE SPACE CONSTRAINTS Research Report
Kailash C. Kapur Apr. 1969 123 p refs
(Grant NSF GP-8695)
(PB-184293; ORC-69-9) Avail: CFSTI CSCL 12A

The report proposes an algorithm for finding optimal solution of optimal control systems with state space constraints. The method reduces the linear optimal control system with state space constraints, which is difficult to solve, to a sequence of optimal linear control systems without state space constraints which are much easier to solve and various methods exist for their solution. It is also shown that a control system with state space constraints can be solved by direct discretization and solving a sequence of finite-dimensional mathematical programs for which efficient computer codes are available. Author (USGRDR)

N70-10299# Vanderbilt Univ., Nashville, Tenn.
REPRESENTATIONS OF PRIMARY ARGUESIAN LATTICES
Bjarni Jonsson and George S. Monk 1968 77 p refs
(Grants NSF GP-7252; NSF GP-1612; NSF GP-6545)
(PB-184288) Avail CFSTI CSCL 12A

The principal result states that every primary Arguesian lattice of geometric dimension three or more is isomorphic to the lattice of all submodules of a finitely generated module over a completely primary uniserial ring. Author (USGRDR)

N70-10304# Vanderbilt Univ., Nashville, Tenn.
ALMOST DIRECT PRODUCTS AND SATURATION
Bjarni Jonsson and Philip Olin (Cornell Univ.) 1969 12 p refs
(Grants NSF GP-7252; NSF GP-6182)
(PB-184103) Avail: CFSTI CSCL 12A

The purpose of this note is to prove that a certain reduced product of countably many relational structures of a countable similarity type always is an omega sub one-saturated structure. Author (USGRDR)

N70-10305# Ohio State Univ. Research Foundation, Columbus.
ON CLASS NUMBERS OF ALGEBRAIC NUMBER FIELDS
Manohar L. Madan 1969 5 p refs
(Grant NSF GP-8979)
(PB-183998) Avail: CFSTI CSCL 12A

It is well known that there exist infinitely many quadratic number fields of which the class number is divisible by any given power of 2. Using class field theory, it has been shown that given any power q superscript f of an odd prime q, there exist infinitely many normal extensions of the field of rational numbers of degree q of which the class number is divisible by q superscript f. Recently, Ishida has proven this result for non-normal extensions. In this paper, we give a unified approach and obtain, what we believe are, simpler proofs of these results. We also generalize these results. Author (USGRDR)

N70-10306# Columbia Univ., New York. Dept. of Mathematics.
THE INVARIANCE OF WAVE OPERATORS ASSOCIATED WITH PERTURBATIONS OF DELTA
Norman Shenk 1968 36 p refs
(Grant NSF GP-5455)
(PB-184001; CU-25) Avail: CFSTI CSCL 12A

Eigenfunction expansions are used to give new proofs of the existence, completeness, and invariance of the Schroedinger wave operators. USGRDR

N70-10309# New Mexico Univ., Albuquerque. Mathematics and Statistics Dept.
UNIFORMLY MOST ACCURATE UPPER TOLERANCE LIMITS IN THE POISSON CASE, AND ITS APPLICATION TO INVENTORY CONTROL
S. Zacks Oct. 1968 12 p refs
(Contract NSF GP-9007)
(PB-183937; TR-2) Avail: CFSTI CSCL 12A

Generally it is difficult to find and explicit expression for tolerance limits in the discrete parametric case, and one is tempted to use a somewhat less efficient distribution free limits. In the Poisson case, however, an explicit expression for the tolerance limits can be derived by relating them to the corresponding uniformly most accurate onesided confidence limit for the mean. The derived

system of tolerance limits is called uniformly most accurate. The purpose of the present note is to present this idea. Upper and lower tolerance limits in the Poisson case are required statistics in various fields of applied probability, like inventory and reliability theories. The application to sequential adjustment of inventory is shown. Author (USGRDR)

N70-10312# System Development Corp., Santa Monica, Calif.
ENTHYMEMES
Hans Kamp Jan. 1969 14 p refs
(PB-184369; SDC-TM-4168) Avail: CFSTI CSCL 12A

The paper presents two possible interpretations of the notion of enthymematic entailment. The first explains enthymematic entailment in terms of logical derivability; the second gives an explanation in terms of logical necessity and material implication. Two explanations, previously proposed by Anderson and Belnap, can be formulated as special cases of the second treatment. But the latter does not suffer from the drawbacks that these special cases can easily be seen to have. Author (USGRDR)

N70-10341# Vanderbilt Univ., Nashville, Tenn.
A SURVEY OF RECENT RESULTS ON TWO SUBALGEBRA PROBLEMS OF B. JONSSON
Thomas P. Whaley 1968 8 p refs
(Grant NSF GP-7252)
(PB-184282) Avail: CFSTI CSCL 12A

The purpose of this note is to outline the work done in the past few years pertaining to the following two problems: (1) For a given cardinal m, is there an algebra of power m having finitely many operations and having no proper subalgebra power m. (2) F a given cardinal m, is there an algebra of power m having finitely many operations and satisfying the descending chain condition for subalgebras. Results are discussed. USGRDR

N70-10356# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
A DIGITAL COMPUTER PROGRAM FOR APPLYING THE KOLMOGOROV-SMIRNOV TESTS OF SIMILARITY TO TWO SAMPLE POPULATIONS
F. C. Gatt Jul. 1969 12 p refs
(AAEC/TM-504) Avail: CFSTI

FORTRAN 4 digital computer program has been prepared for estimating the similarity between two parent population distribution functions, using the Kolmogorov-Smirnov test which is based on the maximum difference between two sample cumulative distributions. The similarity of the functions is determined by a percentage level of significance. Author

N70-10393# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
AN OPTIMAL CONTROL ALGORITHM BASED ON AN INITIAL COSTATE SEARCH
Louis G. Birta and Peter J. Trushel Apr. 1969 57 p refs
(NRC-MK-25; NRC-10821) Avail: CFSTI

An algorithm is presented for solving a wide class of optimal control problems. The algorithm is based on the reformulation of the associated two point boundary value problem as a multi-dimensional minimization problem. Two techniques are considered for solving the one dimensional minimization problem; the first is a polynomial interpolation technique, and the second a scheme based on the Fibonacci search. A variety of example problems are solved to demonstrate both the scope and the effectiveness of the algorithm. Author

N70-10396 Stanford Univ., Calif.
ADAPTIVE ESTIMATION WITH MUTUALLY CORRELATED TRAINING SAMPLES
Thomas Piatt Daniell (Ph.D. Thesis) 1968 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-8170

An algorithm is proposed which employs sufficient generality to include several previously proposed algorithms as special cases. The difference between the optimum weighting vector and the adaptive weighting vector at time i is V sub i. The analysis of the generalized algorithm requires that the data vectors possess only a few properties; foremost among these is ergodicity, stationarity of the second and fourth order moments; and a form of asymptotic independence. Several classes of data sequences are presented which have the properties assumed. Among these is a class of bounded, finite order Markov processes. Application of the analysis of the generalized algorithm to particular estimation problems is illustrated by several examples. Dissert. Abstr.

N70-10398 Purdue Univ., Lafayette, Ind.
SYNTHESIS OF TIME-OPTIMAL CONTROL FOR SECOND-ORDER NONLINEAR SYSTEMS
Anneliese Boettiger (Ph.D. Thesis) 1968 70 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-7423

Results are given on the synthesis of time-optimal control for a second order nonlinear system. The problem is to determine the feedback control as a function of the state variables. This is equivalent to finding the switching focus, since the time-optimal control is a relay control. The nonlinear system is represented by a soft spring characterized by the Duffing equation with negative nonlinear term. The domain of controllability is described. For the case that the coefficient of the nonlinear term is sufficiently small procedure is developed which determines the maximum number of switchings. Also the influence of damping is considered. An analytic expression of the feedback control is derived for the conservative case. This expression contains a hyper-elliptic integral of the first kind. Since this integral cannot be solved in closed form estimates are derived to show the existence or nonexistence of a switching point in certain regions of the domain of controllability. Dissert. Abstr.

N70-10450# George Washington Univ., Washington, D.C.
AN EMPIRICAL COMPARISON OF TYPOLOGICAL ANALYSIS METHODS Final Report
Charles E. Rice and Maurice Lorr 15 Aug. 1969 111 p Prepared in cooperation with Catholic Univ.
(Contract N00014-67-A-0214)
(AD-692484) Avail: CFSTI CSCL 12/1

The purpose of this project was to compare several methods of typological analysis by using each method with a number of data sets. Typological analysis (also called cluster analysis) is concerned with aggregates of objects, each measured with respect to a number of attributes. The aim of these methods is to discover a meaningful ordering or classification scheme for the objects using no information other than the attribute measures and relations among the objects. Object similarity is one such relationship; this is typically quantified as either a Euclidian distance measure or as an index of angular separation, such as the product moment correlation coefficient. Author (TAB)

N70-10478# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
THE LIMITING DISTRIBUTION OF THE MAXIMUM TERM IN A SEQUENCE OF RANDOM VARIABLES DEFINED ON A MARKOV CHAIN
Augustus J. Fabens (Boston Coll.) and Marcel F. Neuts Aug. 1969 17 p refs Prepared in cooperation with Cornell Univ. *Its* Mimeograph Ser. 199
(Contract Nonr-1100(26))
(AD-692397; TR-77) Avail: CFSTI CSCL 12/1

Gnedenkos classical work on the limit of the distribution of the maximum of a sequence of independent random variables is extended to the distribution of the maximum of a sequence of random variables defined on a finite Markov chain. Author (TAB)

N70-10478# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
LIMIT LAWS FOR MAXIMA OF A SEQUENCE OF RANDOM VARIABLES DEFINED ON A MARKOV CHAIN
Sidney I. Resnick and Marcel F. Neuts Aug. 1969 33 p refs Sponsored in part by NSF Prepared in cooperation with Cornell Univ. *Its* Mimeograph Ser. 201
(Contract Nonr-1100(26))
(AD-692399; TR-81) Avail: CFSTI CSCL 12/1

The limit laws are characterized for the maxima of a sequence of random variables defined on a finite Markov chain which are conditionally independent given the chain. TAB

N70-10488# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
EPS: AN INTERACTIVE SYSTEM FOR SOLVING ELLIPTIC BOUNDARY-VALUE PROBLEMS WITH FACILITIES FOR DATA MANIPULATION AND GENERAL-PURPOSE COMPUTATION. USER'S GUIDE
Coyt C. Tillman, Jr. Jun. 1969 193 p refs
(Contracts Nonr-4102(01); AF-33(657)-10954; F33615-67-C-1530)
(AD-692462; MAC-TR-62; ESL-R-395) Avail: CFSTI CSCL 9/2

A users guide for EPS is presented. EPS solves two-dimensional boundary-value problems for elliptic systems of second-order partial differential equations. It also has general-purpose capabilities which permit the on-line definition and execution of arbitrary numerical procedures. The guide is primarily concerned with using EPS to solve boundary-value problems. Linear problems of this type that have no free surfaces or undefined parameters can be solved on a one-pass basis. Nonlinearities and other complications can be handled by iteration. A finite-difference method is employed which permits the use of irregular lattices, hence the crowding of nodes in sensitive regions. EPS operates on the IBM 7094 computer of the M.I.T. Compatible Time-Sharing System (CTSS), and exploits to an unusual degree the potential for interactive problem solving that CTSS affords. Input commands resemble statements in various algebraic compiler languages, and can be combined and abbreviated by means of macros. Improper input and other error conditions are handled so as to minimize user inconvenience. Common syntax errors, for example, are corrected automatically by the machine. Output is available in either numerical or graphical form. Author (TAB)

N70-10498# California Univ., Los Angeles. Dept. of Engineering.
TECHNIQUES OF SYSTEM IDENTIFICATION. LECTURE NOTES
A. V. Balakrishnan May 1969 88 p refs Conf. held at Rome Univ., 16–20 Sep. 1968
(Contract AF-AFOSR-1408-68)
(AD-692512; AFOSR-69-1851TR) Avail: CFSTI CSCL 12/1

In applying optimal control ideas to practical systems and particularly as such applications embrace an ever-increasing class of systems, it is often the case that the kind of description demanded by that theory is not available or is incomplete, and must be deduced from external measurements. The general problem that this leads to is the identification of a system from input-output measurements and is important in areas outside engineering such as economics, physiology, etc. This course will deal with the techniques of system identification as applied to engineering industrial problems. Author (TAB)

N70-10502# Joint Publications Research Service, Washington, D.C.
CYBERNETICS AND REGULATION THEORY
8 Aug. 1969 15 p Transl. into ENGLISH from Russian Journal (JPRS-48587) Avail: CFSTI

CONTENTS:

1. CORRECTION CAPACITIES OF LINEAR CODES M. V. Kozlov p 1–8 refs (See N70-10503 01-19)
2. BULGAKOV'S PROBLEM OF THE ACCUMULATION OF PERTURBATIONS V. V. Aleksandrov p 9–13 refs (See N70-10504 01-19)

N70-10503# Joint Publications Research Service, Washington, D.C.
CORRECTION CAPACITIES OF LINEAR CODES [O KORREKTIRUYUSHCHIKH SPOSOBNOSTYAKH LINEYNYKH KODOV]
M. V. Kozlov *In its* Cybernetics and Regulation Theory 8 Aug. 1969 p 1–8 refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 186, no. 2, 1969 p 275–278 (See N70-10502 01-19)
Avail: CFSTI

Theorems and their proofs are presented, and the problems of minimum weight, probability, and random vectors connected with the correction capabilities are considered. N.E.N.

N70-10504# Joint Publications Research Service, Washington, D.C.
BULGAKOV'S PROBLEM OF THE ACCUMULATION OF PERTURBATIONS [K ZADACHE BULGAKOVA O NAKOPLENII VOZMUSHCHENIY]
V. V. Aleksandrov *In its* Cybernetics and Regulation Theory 8 Aug. 1969 p 9–13 refs Transl. into ENGLISH from Dok. Akad. Nauk SSSR (Moscow), v. 186, no. 3, 1969 p 526–528 (See N70-10502 01-19)
Avail: CFSTI

A mathematical discussion is presented on an extremum problem of the accumulation of perturbations in linear systems. The worst perturbations of the dynamic system and the maximum deviation of the perturbations are determined. N.E.N.

N70-10505# Illinois Univ., Urbana. Coordinated Science Lab.
ON SOME THEORETICAL AND COMPUTATIONAL ASPECTS OF THE MINIMAX PROBLEM
%Juraj Medanic Jul. 1969 38 p refs
(Contract DAAB07-67-C-0199; Grants AF-AFOSR-1579-68; NSF-GK-3893)
(AD-692194; R-423) Avail: CFSTI CSCL 12/2

The report contains both a brief summary of the pertinent theory of the minimax problem in finite dimensional spaces and the development of an elimination type algorithm for the practical computation of the minimax solution. Because algorithms for finding saddle point type solutions are easier to implement it is of considerable interest to know when they can be used in minimax problems. A lemma giving sufficient conditions for the minimax to be a local saddle point is presented in the paper. However, the most interesting minimax problems do not admit saddle point solutions and other algorithms must be sought. Two lemmas are given in the paper which guarantee the convergence of the elimination algorithm proposed in the paper for the computational solution of the minimax problem. A shortcoming of the algorithm is that its application is restricted to minimax problems in which the max function is pseudo-convex. Author (TAB)

N70-10513 Purdue Univ., Lafayette, Ind. Dept. of Statistics.
SOME CONTRIBUTIONS TO MULTIPLE DECISION SELECTION AND RANKING PROCEDURES
S. Panchapakesan Aug. 1969 134 p refs *Its* Mimeograph Ser. No. 192
(Contract F33615-67-C-1244)
(AD-692528) Avail: CFSTI CSCL 12/1

Let Pi sub i,i = 1,...,k, be a continuous population with associated distribution function F sub lambda sub i, (lambda sub i) epsilon Lambda an interval on the real line. Chapter I defines a class of procedures for selecting a non-empty subset of the k populations, such that the probability of a correct selection (PCS), i.e. selection of a subset which includes the population with the largest (smallest) lambda sub i, is at least P^*, a preassigned level. A generalization of a result of Lehmann is used to obtain a sufficient condition for the monotonicity of a probability integral

leading to the evaluation of the infimum of PCS over the parameter space. Results concerning the supremum of the expected subset size are obtained. More specific results are obtained when the density f sub lambda (x) is a convex mixture of a sequence of known density functions. The next chapter examines the selection from multivariate normal populations in terms of multiple correlation coefficient and illustrates the applications of the results of Chapter I. In Chapter III, a partial ordering (h-ordering) is defined on the space of probability distributions and selection from populations h-ordered w.r.t. a known distribution G is discussed. The last chapter briefly discusses some possible variations in the goal and the procedures. Author (TAB)

N70-10531*# Purdue Univ., Lafayette, Ind.
MAXIMUM LIKELIHOOD IDENTIFICATION OF STOCHASTIC LINEAR SYSTEMS
R. L. Kashyap Aug. 1968 31 p refs
(Grants NGL-15-005-021; NSF GK-1970)
(NASA-CR-106618; TR-EE-68-28) Avail: CFSTI CSCL 12A

The paper deals with the maximum likelihood (ML) estimation of the coefficients of a discrete linear system described by a set of coupled difference equations either from the input-output data or from the output data alone. The input, measurements, and methods may be noisy. The methods also estimate the covariances of the disturbing noise. Moreover, the schemes can be modified to allow for real time operation, but the estimates are no longer ML except in the asymptotic sense. Computational results are given for a third order system. Author

N70-10538# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
MULTIVARIATE SEMI MARKOV MATRICES
Marcel F. Neuts Aug. 1969 17 p refs Prepared in cooperation with Cornell Univ. *Its* Mimeograph Ser. 200
(Contract Nonr-1100(26))
(AD-692398; TR-78) Avail: CFSTI CSCL 12/1

A natural combination of the theories of stochastic matrices and of distribution functions, which arises in a large number of problems of analytic Probability theory, is the theory of semi-Markov matrices. The paper considers properties of semi-Markov matrices involving multivariate distributions. TAB

N70-10608# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
AN INCLUSION THEOREM FOR LINEAR OPERATORS
Johann Schroeder Jul. 1969 17 p refs *Its* Mathematical Note-609
(AD-691901; D1-82-0873) CSCL 12/1

There are derived necessary and sufficient conditions such that Mu is a member of C implies u is a member of K where M is a linear operator, K is a closed set and C is a convex set. In particular, for matrices M, the following property is investigated: -phi = or < Mu = or < psi implies -phi = or < u = or < psi. Moreover, connections with inverse-positivity are discussed. Author (TAB)

N70-10614*# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Systems Research Section.
FURTHER DEVELOPMENT OF AN ALGORITHM FOR THE NONLINEAR STABILITY ANALYSIS OF THE ORBITING ASTRONOMICAL OBSERVATORY PAIRED-TRACKER CONTROL SYSTEM Final Report
G. Geiss, V. Cohen, R. D'heedene, D. Rothschild, and A. Chomas Aug. 1969 266 p refs
(Contract NAS2-4063)
(NASA-CR-73383; RE-369) Avail: CFSTI CSCL 12A

This report describes a study directed toward development of an effective algorithm for estimating the domain of attraction of the equilibrium state of the OAO "paired-Tracker" coarse pointing mode attitude control system via "optimal" quadratic form Liapunov functions. The algorithm is developed by formulating the estimation problem as a min-max problem which is solved by random search techniques. The model of the system is reviewed, and several approximations to it are developed. A Popov type stability analysis is carried out for a simplified model to determine if it is absolutely stable and to formulate a Luré type Liapunov function to be used in the estimation procedure. The results of the analysis were negative due to a pole at the origin of the linear part of the system and because the dominant nonlinearity was saturation. The algorithm is tested on both the full nine dimensional model and a six dimensional approximation. The results for both are similar, but disappointing by comparison to simulation results. Author

N70-10638*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN EXPERIMENTAL COMPARISON OF SEVERAL APPROACHES TO THE LINEAR LEAST SQUARES PROBLEM
Eugene J. Lefferts and Daniel P. Muhonen Sep. 1969 60 p
(NASA-MT-X-63722; X-551-69-422) Avail: CFSTI CSCL 12A

Several computational algorithms for obtaining least square solutions to a system of equations are made. The algorithms include both conventional and pseudo inversion methods. Comparisons of running time, computer storage and accuracy of recovery are made for each algorithm in both single and double precision. Author

N70-10639*# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
A NEW METHOD OF RECURSIVE ESTIMATION IN DISCRETE LINEAR SYSTEMS
R. L. Kashyap Jun. 1968 22 p refs
(Grants NGL-15-005-021; NSF GK-1970)
(NASA-CR-106617; TR-EE-68-13) Avail: CFSTI CSCL 12A

Let the measurement z(i) at instant i be of form z(i) = y (i) + eta(i) where eta(i) is the noise and y(i) is the signal obeying a system of coupled linear difference equations of varying orders. A recursive equation was derived for innovation or orthogonalized measurement. Using this equation, algorithms are derived for prediction, filtering and smoothing of the signal u(i). The use of these schemes results in considerable reduction of computation over existing schemes. If z(i) is a scalar, the relative computational efficiency is N/2 where N is the dimension of state vector. Author

N70-10663# Wisconsin Univ., Madison. Computer Sciences Dept.
CONVERGENCE OF SOME GRADIENT LIKE METHODS FOR CONSTRAINED MINIMIZATION
James W. Daniel Jul. 1969 25 p refs
(Contract N00014-67-A-0128)
(AD-692413; TR-65) Avail: CFSTI CSCL 12/2

Some step-length algorithms are analyzed and convergence proved for a general class of feasible direction algorithms for constrained minimization. Applications are given to the conditional gradient and variable metric projected gradient methods. Author (TAB)

N70-10685*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NUMERICAL SOLUTION OF DIFFERENTIAL EQUATIONS USING BRECHKOFF CORRECTOR FORMULAS
Joseph S. Rosen Washington Nov. 1969 13 p refs
(NASA-TN-D-5470) Avail: CFSTI CSCL 12A

The solution of differential equations by predictor–corrector formulas which give high order accuracy is considered. These formulas are characterized by the fact that they contain higher derivatives of the unknown function y(x), and if their derivatives are readily determinable, fewer terms are needed for a given order as compared to other multistep methods which do not involve derivatives. Corresponding to these corrector formulas, certain new predictor, or extrapolation, formulas are suggested. These formulas also make use of the derivatives used in the corrector formulas. Author

N70-10690 National Lending Library for Science and Technology, Boston Spa (England).
ON THE DIFFERENTIAL PROPERTIES OF THE SOLUTION OF THE FIRST BOUNDARY PROBLEM FOR A NONSTATIONARY SYSTEM OF NAVIER-STOKES EQUATIONS [O DIFFERENTSIALNYKH SVOISTVAKH RESHENIYA PERVOI KRAEVOI ZADUCHI DLYA NESTATSIONARNOI SISTEMY URAVENNII NAVE-STOKSA]
V. A. Solonnikov Jul. 1969 110 p refs Transl. into ENGLISH from Tr. Mat. Inst., Akad. Nauk SSSR (Moscow), v. 73, 1964 p 221–291
(NLL-RTS-5211) Avail: Natl. Lending Library, Boston Spa, Engl.: 40s

A systematic analysis of the solution for the first boundary problem of certain Hoelder classes is presented. These classes are characterized by spaces with fractional indices where 1 and 21 are required to be nonintegral, and a set of functions having specified differential properties with restrictions on the vectors. The functions consist of parameters of the lateral surface of a cylindrical region. A prior estimation of the solution is emphasized; two forms of estimating unknown functions, and the introduction of new coordinates are used to represent the unknown functions. Supplementary estimates in a half-space, estimation of the solution near the boundary and inside the region, and estimation of the norm near the boundary, are demonstrated. The theorem developed to solve the first boundary problem for the linearized, nonstationary system of Navier – Stokes equations is proved within the framework of the theory of boundary problems for general elliptic systems. The differential properties of the solution of the nonlinear problem is also demonstrated. M.H.E.

N70-10704# California Univ., Berkeley. Operations Research Center.
NONZERO-SUM STOCHASTIC GAMES
Philip D. Rogers Apr. 1969 45 p refs
(Contract Nonr-222(83))
(AD-692394; ORC-69-8) Avail: CFSTI CSCL 12/2

The paper extends the basic work that has been done on zero-sum stochastic games to those that are nonzero-sum. Appropriately defined equilibrium points are shown to exist for both the case where the players seek to maximize the total value of their discounted period rewards and the case where they wish to maximize their average reward per period. For the latter case, conditions required on the structure of the Markov chains are less stringent than those imposed in previous work on zero-sum stochastic games, extensions to n-person games and underlying semi-Markov processes are discussed, and finding an equilibrium point is shown to be equivalent to solving a certain nonlinear programming problem. Author (TAB)

N70-10705# California Univ., Berkeley. Operations Research Center.
ON AVAILABILITY IN COMPOUND POISSON DEMAND INVENTORY SYSTEMS
William S. Jewell May 1969 13 p refs
(Contract DA-31-124-ARO(D)-331)
(AD-692396; ORC-69-13) Avail: CFSTI CSCL 15/5

Three possible performance measures in compound-Poisson demand inventory systems can be used to describe the availability of stock to a customer. Simple relationship between these three availabilities are derived under general assumptions about the inventory process. Author (TAB)

N70-10757# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Flight Dynamics Lab.
OPTIMAL OPEN-LOOP CONTROL OF STOCHASTIC SYSTEMS Final Report, Oct. 1967–Jan. 1969
James D. Dillow Jul. 1969 120 p refs
(AD-692479; AFFDL-TR-69-17) Avail: CFSTI CSCL 12/1

The problem of optimal open-loop control of stochastic systems is treated. The system is assumed to be modeled by a stochastic differential equation and the admissible controls are taken to be deterministic functions of time. The optimal control is the control which minimizes the expected value of a quadratic cost function. For the case where the stochastic differential equation is nonlinear, sufficient conditions are described for the existence of an optimal control. Under certain conditions on the problem, the optimal control is shown to satisfy a necessary condition. A computational algorithm is suggested for computing the optimal control. For the case where the stochastic differential equation is linear, sufficient conditions are described for the existence of a unique optimal control. Under certain conditions on the problem, a necessary and sufficient condition for the optimal control is demonstrated. Two computational algorithms for computing the optimal control are described and conditions for convergence are given. Author (TAB)

N70-10768# Naval Postgraduate School, Monterey, Calif.
SINGULAR LINE COMPENSATION IN THE PARAMETER PLANE
Lawrence Bruce Shapiro (M.S. Thesis) Apr. 1969 83 p refs
(AD-692448) Avail: CFSTI CSCL 12/1

Previous work on the parameter plane, three dimensional parameter space, and singular lines in the parameter plane are reviewed. A general concept of n-dimensional parameter space is hypothesized whereby the parameter plane becomes a special case of the general hypothesis. By the same argument the singular line is shown to be a special case of the singular hyperplane. Existence criteria for singular lines are established, and compensation methods for creating singular lines in non-singular systems are derived and used. Author (TAB)

N70-10769# Wisconsin Univ., Madison. Computer Sciences Dept.
STABILITY ANALYSIS IN DISCRETE MECHANICS
Colin W. Cryer Jun. 1969 21 p refs
(Contract N00014-67-A-0128)
(AD-692414; TR-67) Avail: CFSTI CSCL 20/11

Greenspan has developed a discrete version of Newtonian mechanics, called discrete mechanics, which he has used to derive finite difference approximations to nonlinear problems in mechanics. The stability of one of these finite difference approximations is analyzed in detail using the energy method. It is found that the theoretical stability limit agrees exactly with the stability limit observed experimentally. Author (TAB)

N70-10786# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
SINGULAR TIME OPTIMAL CONTROL
Rufus Oldenburger and Sadao Hayano 1 Sep. 1969 33 p refs
(Contract Nonr-1100(20))
(AD-692476; TR-5) Avail: CFSTI CSCL 12/1

A slightly different definition of singular time optimal control from the usual sense is given here. A system is said to be singular if more than one optimal control exists for a given boundary condition. The characteristics of the newly defined singular control problem are studied where the system is assumed to be linear, time invariant and expressed by vector differential equations. The controls are Lebesgue measurable functions and belong to a compact convex set. It is demonstrated through example that Pontryagins Minimum Principle is useful for the singular control problem. The minimum principle contains implicit information regarding the singular system. A standard procedure is shown to solve the singular problem. Methods of linear algebra are taken to analyze the system in this paper. Author (TAB)

N70-10798# Illinois Univ., Urbana. Dept. of Civil Engineering.
MATRIX TREATMENT OF THE ERROR ELLIPSOID
R. C. Malhotra Aug. 1969 58 p refs *Its* Photogrammetry Series No. 24
(Grant NSF GK-1888)
(PB-185560) Avail: CFSTI CSCL 12A

An error ellipsoid may be defined as a surface of equal probabilities of location of a point in 3-dimensional space, the probabilities considered being according to the law of normal distribution. The probability of location of a point within the standard error ellipsoid is 19.9 per cent. The analysis of the error ellipsoid of a point location enables one to obtain the standard deviation along the weakest direction of location and also its direction cosines with respect to the reference coordinate system. Besides, one can also deduce the standard deviation of point location in any arbitrary direction. Furthermore, for an overall idea of precision of a point location one may determine the mean radius of error ellipsoid. The analysis of the error ellipsoid may be carried out most efficiently using the technique of eigenvalues and eigenvectors of matrix algebra. Author (USGRDR)

N70-10803# North Carolina State Univ., Raleigh.
ON THE SPHEROIDAL FUNCTIONS OF THE FIRST KIND
Donald R. Rhodes 23 Jun. 1969 48 p refs
(Contract F19628-67-C-0255)
(AD-692121; SR-2; AFCRL-69-0284) Avail: CFSTI CSCL 12/1

A number of new properties of the spheroidal functions of the first kind of arbitrary order alpha <-1 are established, including double orthogonality over two separate intervals simultaneously and the existance of a new kind of characteristic numbers gamma sub(alpha n) that arise from it. A comprehensive collection of computational formulas are derived and a few numerical results are shown. Author (TAB)

N70-10813*# Minnesota Univ., Minneapolis. Space Science Center.
ALGEBRA 1, USER'S REFERENCE MANUAL
10 Aug. 1969 64 p refs
(Grant NGL-24-005-063)
(NASA-CR-106650) Avail: CFSTI CSCL 12A

A manual which provides a detailed description of the language and the required data format for the potential user of Algebra 1 is presented. The Algebra 1 language is described as an interactive language designed for the symbolic manipulation of polynomials and rational functions. It is written in SNOBOL 67, a dialect of SNOBOL 3, and runs on the SDS 940 under the COMSHARE W-series Executive System. The language was designed with the importance of man-machine interactions as a prime consideration, and the operation of the language on a time-shared facility, a necessity. The system was applied in: (1) determining equilibrium conditions in structural mechanics, (2) perturbation solutions of nonlinear ordinary differential equations, (3) orbit calculations, and (4) studies of high energy particle interactions. F.O.S.

N70-10818# Vanderbilt Univ., Nashville, Tenn.
STIFF GROUPS AND WILD SOCLES
Charles Megibben 1968 9 p refs
(Grant NSF GP-7252)
(PB-184273) Avail: CFSTI CSCL 12A

Limiting conditions are given for the existence of socles and subsocles in a primary Abelian group. Wild socles are shown to exist after the proper multiplication by an integer of a dense subsocle, and stiff groups are shown to exist after the proper multiplication of an Abelian group by an integer. It is then proven that a group is stiff if it has a wild socle. B.G.D.

N70-10901*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GRAPHS, NUMBER SYSTEMS, AND ARITHMETIC CODES
Oscar N. Garcia (Old Dominion Univ.) Sep. 1969 18 p refs
(NASA-TM-X-63730; X-711-69-384) Avail: CFSTI CSCL 12A

Preliminary results obtained in using graphs to represent number systems and in the converse question of what class of graphs represents number systems are presented. Because arithmetic codes are finite redundant number systems, they are considered for improving the reliability of digital computer arithmetic through redundancy in the information processed. The representation of the integers forming an algebraic group by sets of binary strings of a given identical length, the rules that govern the addition of the elements of the set of binary strings forming the binary code, and the weights associated with each position of the binary string are investigated. Author

N70-10903# Iowa Univ., Iowa City. Dept. of Mathematics.
THE CLASS OF REGULAR SETS IS PROPERLY CONTAINED IN THE CLASS OF PRIMITIVE RECURSIVE SETS
Gerard P. Weeg Jun. 1969 11 p refs
(Contract N00014-68-A-0500)
(AD-691258; TR-10) Avail: CFSTI CSCL 12/1

It was stated in Kleene that every regular set is a primitive recursive set. Since, however, regular sets are certain subsets of a finitely generated free semigroup, while primitive recursive sets are subsets of the natural numbers, the relationship between the two concepts is not obvious. In this paper an appropriate mapping into the natural numbers is introduced, allowing a straightforward proof of titled result. Author (TAB)

N70-10962# Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.
NUMERICAL ANALYSIS AND DATA ANALYSIS IN SUPPORT OF SCIENTIFIC RESEARCH Final Report, 1 Jan.–31 Dec. 1968
Richard W. Doherty, Joseph F. Russell, Rose M. Ring, and Neil Grossard 31 Jan. 1969 85 p refs
(Contract F19628-68-C-0202)
(AD-6921519; AFCRL-69-0318) Avail: CFSTI CSCL 12/1

The report describes the data analysis, numerical analysis and programming performed in the solution of varied scientific problems during this year. These problems range in complexity from the numerical approximation of complicated double and triple integrals and numerical solutions for systems of non-homogeneous integral equations using integral approximations, to the classical solution of a system of non-homogeneous equations and the root solutions of cubic equations with varying coefficients. Each problem encountered is presented in capsule form and its solution is outlined. Author (TAB)

N70-10991# Vanderbilt Univ., Nashville, Tenn.
CLASSES WITHOUT THE AMALGAMATION PROPERTY
S. D. Comer 1969 19 p refs
(Grant NSF GP-7252)
(PB-184031) Avail: CFSTI CSCL 12A

The contents of this paper belong to the general algebraic theory of those algebras which are studied in connection with algebraic logic. The main results, Theorems 1 and 2, give sufficient conditions for the amalgamation and the embedding property to fail in a class of Boolean algebras with operators. As a corollary, for 1 < alph < omega the amalgamation property fails in the class of all (representable) cylindric algebras of dimension alpha and in the class of all (representable) polyadic (equality) algebras of dimension alpha. Thus, there are finitely axiomatizable equational classes of Boolean algebras with operators for which the amalgamation property fails. Author (USGRDR)

N70-11015# Iowa Univ., Iowa City. Dept. of Mathematics.
SEMIGROUPS SATISFYING RING-LIKE CONDITIONS
Wendell P. Jones May 1969 59 p refs
(Contract N00014-68-A-0500; THEMIS PROJ.)
(AD-691257; TR-9) Avail: CFSTI CSCL 12/1

A subset R(S) of a semigroup S is introduced and examined under special conditions. Arising from the study is the following characterization: R(S) = S if and only if each element of S has finite order and each idempotent element is a left zero of S. But R(S) = S is equivalent to the condition that S has no modular right congruences different from the universal congruence. Hence, in the setting of automaton theory, R(S) = S if and only if every strictly cyclic automaton over S is isomorphic to S/upsilon, the null automaton of cardinality one. Equivalently, every strictly cyclic automaton over S is the null automaton of cardinality one if and only if each element of S has finite order and each idempotent element is a left zero of S. Author (TAB)

N70-11019*# Rice Univ., Houston, Tex. Dept. of Mechanical and Aerospace Engineering and Materials Science.
GRADIENT METHODS IN CONTROL THEORY. PART 2: SEQUENTIAL GRADIENT-RESTORATION ALGORITHM
A. Miele and R. E. Pritchard 1969 41 p refs
(Grant NGR-44-006-089)
(NASA-CR-106749; AAR-62) Avail: CFSTI CSCL 12A

This paper considers the problem of minimizing a functional I which depends on the state x(t), the control u(t), and a parameter pi. Here, I is a scalar, x an n-vector, u an m-vector, and pi a p-vector. At the initial point, the state x is prescribed. At the final point, the state x and the parameter pi are required to satisfy q scalar relations. Along the interval of integration, the state, the control, and the parameter are required to satisfy n scalar differential equations. A sequential algorithm composed of the alternate succession of gradient phases and restoration phases is presented. Author

N70-11023# Iowa Univ., Iowa City. Dept. of Mathematics.
ON S STAR SEMIGROUPS OF AUTOMATA
Robert H. Oehmke May 1969 15 p
(Contract N00014-68-A-0500; THEMIS Proj.)
(AD-691256; TR-8) Avail: CFSTI CSCL 12/1

A converse of a theorem of Hedetniemi and Fleck is proven in this paper, relating the semigroup of an automaton to the graph of the automaton. Author (TAB)

N70-11032# Michigan State Univ., East Lansing. Dept. of Statistics and Probability.
ON INTERPOLATION OF Q-VARIATE STATIONARY STOCHASTIC PROCESSES
Habib Salehi Aug. 1968 16 p refs
(Grants NSF-GP-7535; NSF-GP-8614)
(PB-184109; RM-212) Avail: CFSTI CSCL 12A

Let 'x sub t be a q-variate stationary stochastic process. Let K be any set of t-values and let K' be the complement of K. If x epsilon K' the problem of approximating x sub s by linear combinations of the (x sub t)s with t epsilon K and limit of such linear combinations is considered. The best linear predictor and the means square error matrix are evaluated in the following cases: (1) t taken on all real values. K consists of the integers. (2) t is integer-values. K consists of the odd integers. Author (USGRDR)

N70-11044# Harry Diamond Labs., Washington, D.C.
A TIME-DOMAIN APPROACH TO SAMPLED-DATA SERVOMECHANISM CONTROL
Edward R. Sebol May 1969 14 p
(AD-692294; HDL-TR-1449) Avail: CFSTI CSCL 12/1

The concept of reverse convolution in sampled-data systems is developed by first considering forward convolution, and its application to servomechanism control is briefly discussed. In addition, some readily observable properties of sampled impulse responses are mentioned. Author (TAB)

N70-11047# Naval Ammunition Depot, Crane, Ind.
A COMPARISON OF THREE METHODS OF ANALYZING ATTRIBUTE DATA IN A TWO-FACTOR CLASSIFICATION
Donald L. Jerger Jun. 1969 52 p refs
(AD-691237; QETR-1) Avail: CFSTI CSCL 12/1

The report describes a comparison of three methods of analyzing attribute data in a two-factor classification. Sets of proportions (where each proportion is based on a sample of ten) were developed within the constraints of various combinations of seven influencing factors. Each set of proportions was subjected to factorial analysis by the (0, 1) analysis of variance, factorial chi-square, and arcsine transformation of proportions methods. Using the percentage points of the F or chi-square distribution which coincide with each application of the three methods as response data, an analysis of factors influencing these percentage points was undertaken. The results of this analysis were used to conclude that the arcsine transformation of proportions method is the best of the three for use within the levels of the factors studied in this report. Author (TAB)

N70-11086 National Lending Library for Science and Technology, Boston Spa (England).
ON THE BOUNDARY PROBLEM FOR THE NAVIER-STOKES EQUATION [O KRAEVOI ZADACHE DLYA URAVNENII NAVIER-STOKESA]
K. K. Golovkin Jul. 1969 28 p refs Transl. into ENGLISH from Tr. Mat. Inst. (Moscow), v. 73, 1964 p 118-138
(NLL-RTS-5240) Avail: Natl. Lending Library, Boston Spa, Engl.: 40s

The boundary problem is investigated for nonstationary Navier-Stokes equations with three-dimensional variables. Specifically, the three-dimensional theory of nonstationary hydrodynamic potentials is used in search for a solution to such boundary problems and their differential characteristics. A.C.R.

N70-11117# Vanderbilt Univ., Nashville, Tenn.
AN ABELIAN P-GROUP WITHOUT THE ISOMORPHIC REFINEMENT PROPERTY
A. L. S. Corner and Peter Crawley [1969] 7 p refs
(Grant NSF-GP-7252)
(PB-184105) Avail: CFSTI CSCL 12A

It is well known that a countable reduced abelian p-group G has the isomorphic refinement property, i.e. any two direct decompositions of G have isomorphic refinements, if and only if G has no elements of infinite height. In the uncountable case the situation is characteristically unclear. There do exist uncountable reduced p-groups with nonzero elements of infinite height having the isomorphic refinement property; any p-group whose first Ulm factor is torsion complete and second Ulm factor is cyclic is such a group. And for uncountable p-groups with no elements of infinite height there exist sufficient conditions for the isomorphic refinement property. Yet the question has remained whether the isomorphic refinement property is possessed by all such groups. Here this question is answered in the negative by showing that there exists an abelian p-group with no elements of infinite height having two direct decompositions that do not admit isomorphic refinements. Author (USGRDR)

N70-11143# Vanderbilt Univ., Nashville, Tenn.
ISOMORPHISM TYPES OF INFINITE ALGEBRAS
S. D. Comer and J. J. LeTourneau 1969 8 p ref Prepared in cooperation with Fisk Univ.
(Grant NSF GP-7252)
(PB-184032) Avail: CFSTI CSCL 12A

A basic problem in the general theory of algebras is the determination of the number of nonisomorphic algebras with a given (finitary) similarity type and infinite power. The main result is to show that in every case the number of such algebras actually

equals the most naturally computed upper bound. In particular it is shown that if tau is any similarity type containing n symbols, at least one of which is of positive rank, and m is any infinite cardinal then there exist exactly 2 superscript (m dot n) nonisomorphic algebras with similarity type tau and power m.
Author (USGRDR)

N70-11183# Michigan Univ., Ann Arbor. Systems Engineering Lab.
DEGREE CONSTRAINED SUBGRAPHS OF LINEAR GRAPHS Technical Report, Jan. 1966 - May 1967
Robert J. Urquhart Jul. 1969 164 p refs
(Contract AF 30(602)-3546)
(AD-692221; Rept-06920-10-T RADC-TR-69-123) Avail: CFSTI CSCL 12/1

Given a weighted, undirected graph, a class of combinatorial problems is to find an optimum weighted subgraph, subject to certain degree constraints on the vertices of the subgraph. If the graph is bipartite, problems of this sort are equivalent to the classical transportation and assignment problems of operations research. When the graph is not bipartite, but the degree constraints are unity for all vertices, the problem is that of graphical matching or covering. The matching problem has been solved by Edmonds. The most general problem solved in this thesis is the degree constrained subgraph problem, in which each vertex has a separate upper and lower degree constraint. The factors problem is a special case, where the upper and lower constraints are equal at each vertex. Efficient algorithms for these cases have not previously appeared in the literature. The approach taken to solve these problems is characterized by the use of linear programming theory, both to motivate the algorithm, and to demonstrate the optimality of a solution. The work is shown to be applicable to large scale system design, parallel processing, scheduling, and selection of optimum routings.
Author (TAB)

N70-11178# Wisconsin Univ., Madison. Dept. of Statistics.
ON DISTRIBUTIONS AND THEIR TRANSFORMATION TO NORMALITY
N. R. Draper and D. R. Cox (Imperial College, London) Feb. 1969 13 p ref
(Grant NSF GP-7842)
(PB-184090; TR-189) Avail: CFSTI CSCL 12A

Further consideration is given to a family of power transformations discussed by Box and Cox (1964). It is shown that this family of transformations can be useful even in situations where no power transformation can produce normality exactly. The precision of estimation of the transformation parameter is also discussed.
Author (USGRDR)

N70-11225# Michigan State Univ., East Lansing. Dept. of Statistics and Probability.
INTERPOLATION OF Q-VARIATE HOMOGENEOUS RANDOM FIELDS
Habib Salehi Sep. 1968 14 p refs
(Grants NSF GP-7535; NSF GP-8614)
(PB-184110; RM-215) Avail: CFSTI CSCL 12A

The paper gives generalized results concerning the interpolation of a q variate stationary stochastic process.
Author (USGRDR)

N70-11228# Wisconsin Univ., Madison. Dept. of Statistics.
ON UTILIZING INFORMATION FROM A SECOND SAMPLE IN ESTIMATING VARIANCE
J. S. Mehta and John Garland Oct. 1968 21 p refs Sponsored by NSF
(PB-184089; TR-177) Avail: CFSTI CSCL 12A

Estimators of the variance of a normal population are presented which combine the information from two samples obtained from populations with possibly different variances. One class of these estimators is based on a preliminary test of the equality of variances. Another class is obtained by minimising the mean square error. The behaviour of these classes of estimators is examined from the point of view of efficiency and bias.
Author (USGRDR)

N70-11229# Wisconsin Univ., Madison. Dept. of Statistics.
ON COMBINING UNBIASED ESTIMATORS OF THE MEAN
J. S. Mehta and John Garland Oct. 1968 19 p refs Sponsored by NSF
(PB-184088; TR-176) Avail: CFSTI CSCL 12A

The problem of estimating the common mean of two normal populations whose variances are unknown and may differ is considered. After examining some results are presented, some classes of estimators which are symmetric as well as asymmetric are presented. These are investigated with respect to their efficiencies.
Author (USGRDR)

N70-11230# Wisconsin Univ., Madison. Dept. of Statistics.
SIZE AND POWER OF A TEST FOR EQUALITY OF MEANS IN THE PRESENCE OF CORRELATION
J. S. Mehta (Temple Univ.) and John Garland Apr. 1969 22 p refs
(Grant NSF GP-7705)
(PB-184091; TR-192) Avail: CFSTI CSCL 12A

The statistic for testing the hypothesis concerning equality of means when an imcomplete sample from a bivariate normal population is available is suggested. For a specific sample size it was demonstrated that the test based on this statistic has higher power than the power of the test based on a paired t statistic provided that the population correlation coefficient is nonnegative. Tables of size and power of this test for different sample sizes are provided.
Author (USGRDR)

N70-11298# System Development Corp., Santa Monica, Calif.
NUMERICAL INTEGRATION STUDY Final Report
James Dyer and Mohan Anada 31 Jul. 1969 182 p refs
(Contract F04606-68-C-0777)
(AD-692525; SDC-SP-3406) Avail: CFSTI CSCL 12/1

The theory of generalized high-order multistep methods was previously extended to the special second-order equation y'' = f(x,y), which is pertinent to the two-body problem. Generalized methods for the first-order equation and for the above second-order equation were combined to produce new predictor-corrector algorithms for satellite orbit trajectory computations. Test results in certain representative trajectories are reported.
Author

N70-11307# Stanford Univ., Calif. Dept. of Statistics.
ON SOME PROBLEMS IN OPERATIONS RESEARCH
Ester Samuel 16 Apr. 1969 14 p ref
(Grant NSF GP-5705)
(PB-183939; TR-37) Avail: CFSTI CSCL 12B

The probability of survival of a craft or group under certain perilous conditions is investigated by mathematical methods.
Author (USGRDR)

N70-11315# Iowa Univ., Iowa City. Dept. of Mathematics.
ON INPUTS WITH FIXED POINTS AND QUASI REGULARITY FOR SEMIGROUPS
Robert H. Oehmke Jul. 1969 13 p
(Contract N00014-68-A-0500; THEMIS PROJ.)
(AD-691259; TR-11) Avail: CFSTI CSCL 12/1

A characterization is given of those semigroups S with precisely one element e in S such that for any S-automaton A the only input leaving any states fixed other than dead states, is the input e.
Author (TAB)

N70-11325# Washington Univ., Seattle. Dept. of Mathematics.
ASYMPTOTIC NORMALITY OF LINEAR COMBINATIONS OF FUNCTIONS OF ORDER STATISTICS
Galen R. Shorack Sep. 1968 27 p refs
(Grant NSF-GP-8882)
(TR-18) Avail: CFSTI

Let X sub 1,... X sub N be i.i.d. Uniform (0,1) r.v. defined on a probability space. Let F sub N denote the empirical d.f., and let X sub N1 be less than or equal to X sub NN denote the ordered X sub 1, ..., X sub N. Considered are statistics with a special linear combination of functions where c sub Ni : $1 < i < N$, $N > 1$ is a set of specified constants. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N70-10109 Rutgers Univ., New Brunswick, N.J.
METEOROLOGICAL AND HYDROLOGICAL DROUGHT IN RARITAN RIVER BASIN
Chin-Shu Liu (Ph.D. Thesis) 1968 250 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.25 Order No. 69-7564

This investigation was initiated to study the frequency of occurrence of drought, it severity and its duration in the Raritan River Basin, New Jersey. The short-term historic record requires extension to a longer pierod of record. Use of the meteorological data for back-extending the streamflow data was investigated. Generated sequences of Palmer Drought Indices and stream-flows by the Markov chain model were useful and were utilized for establishing the drought probability distributions of each. It was found that the model has not reproduced the 1961-66 longer duration low flows. Such long persistent low flows would need a multi-lag generation model. The severity and duration of the 1961-66 drought were found to have probability of occurrence of 0.15% or less. Based on the mean maximum drought distribution, this drought had a 250 year or higher frequency. The records during those years were not found to be atypical of that of the years preceding. Dissert. Abstr.

N70-10125# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 29: NEW YORK, NEW YORK LA GUARDIA AIRPORT
Jun. 1969 31 p refs
(FAA Order FA-67-WAI-129)
(SRDS-RD-69-22-Vol-29) Avail: Issuing Activity

Tabulated data covering the period June 1969 are presented for the New York La Guardia Airport. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids for making decisions affecting landing system and fog dissipation at the air terminal. Author

N70-10129# Joint Publications Research Service, Washington
METEOROLOGY
In its Soviet Bloc Res. in Geophys. Astronomy, and Space, No. 209 31 Jul. 1969 p 2-6 refs (See N70-10127 01-34)
Avail: CFSTI

More accurate determinations of vertical air movements in rain are reported, resulting from an improved measurement method. Brief summaries of theoretical and experimental investigations of the following topics are also included: (1) transverse diffusion of impurities in the atmosphere; (2) analysis of tropical hurricane structure; (3) statistical studies of the vertical temperature profile; (4) analysis on internal waves in a nonhomogenious atmosphere; (5) consideration of atmospheric current stability relative to mesoscale disturbances; and (6) turbulent temperature fluctuation determination in the air-ocean surface layer. A.C.R.

N70-10140# Weather Bureau, Fort Worth, Tex. Southern Region Headquarters.
HEMISPHERIC CIRCULATION AND ANOMALY PATTERNS OBSERVED WITH TROPICAL STORMS REACH HURRICANE INTENSITY
Paul J. Herbert and Banner I. Miller May 1969 12 p refs
(PB-184610; WBTM-SR-46) Avail: CFSTI CSCL 04B

During the past several years the composite charts prepared by Ballenzweig (2, 3) have been of assistance to hurricane forecasters in identifying circulation patterns which are either favorable or unfavorable to the formation of tropical cyclones. Composite charts of the average 700-mb circulation and anomaly patterns for those tropical storms which reached hurricane intensity were prepared for the period 1947-1967. The composite charts were obtained by averaging the daily values for each of the three days, regardless of the month in which the hurricane occurred. The anomaly charts are the averages of the departures from the normals, which were obtained by averaging the daily normals for the ten-day period in which the hurricane developed. USGRDR

N70-10143# Weather Bureau, Fort Worth, Tex. Southern Region Headquarters.
ON THE MAXIMUM SUSTAINED WINDS OCCURRING IN ATLANTIC HURRICANES
Charles Holliday May 1969 9 p refs
(PB-184609; WBTM-SR-45) Avail: CFSTI CSCL 04B

The method most frequently used to estimate maximum surface winds occuring in Atlantic hurricanes has been Fletcher's equation. The formula is based on the pressure gradient between the storm's central pressure (P sub c) and peripheral pressure (P sub n). Other formulas based on the same concept are listed. It is the object of this paper to consider which of the various equations available yields the most reasonable values for sustained winds. USGRDR

N70-10152# Colorado State Univ., Fort Collins. Atmospheric Science Dept.
A CLIMATOLOGY OF CENTRAL GREAT PLAINS MESOSCALE CONVECTIVE SYSTEMS
R. A. Dirks Mar. 1969 67 p refs
(Grant ESSA-E10-68-G)
(PB-183988) Avail: CFSTI CSCL 04B

Dynamic and thermodynamic factors associated with squall line development are reviewed along with proposed initiating mechanisms. Mesoscale convective systems (100 km scale) are studied over one summer season (May-August 1966) in the central Great Plains area. Based on satellite photographs, radar observations and standard synoptic data, the spatial and temporal distributions of the formation of these systems are analyzed. The analyses show preferred regions of initial development several hundred kilometers leeward of the Colorado Rockies while in the immediate lee of the mountains convection is largely suppressed. Author (USGRDR)

N70-10175# National Enviornmental Satellite Center, Washington, D.C.
ESTIMATING MAXIMUM WIND SPEED OF TROPICAL STORMS FROM HIGH RESOLUTION INFRARED DATA
L. F. Hubert, A. Timchalk, and S. Fritz May 1969 40 p refs
(PB-184611; ESSA-TR-NESC-50) Avail: CFSTI CSCL 04B

Cloud patterns produced by tropical storms can be mapped from infrared radiation data. An empirical relationship between pattern measurements from Nimbus 2 high resolution infrared data and storms maximum wind speed (MWS) was derived. Two mean radii are related to MWS: the overall canopy size and an inner radius associated with the storm's eye. Author (USGRDR)

N70-10176# National Environmental Satellite Center, Washington, D.C.

SYNOPTIC/DYNAMIC DIAGNOSIS OF A DEVELOPING LOW LEVEL CYCLONE AND ITS SATELLITEVIEWED CLOUD PATTERNS

Harold J. Brodrick and E. Paul Mc Clain May 1969 33 p refs
(PB-184612; ESSA-TR-NESC-49) Avail: CFSTI CSCL 04B

The evolution of a developing low-level baroclinic cyclone and its satellite-viewed cloud patterns is diagnosed with respect to those factors that produced and deformed the cloudiness into characteristic patterns. These factors, viz., vertical motion and circulation in the system, are examined by means of the omega equation and Petterssen's equation for local vorticity tendency at the earht's surface. This type of study can provide background for models relating cloud patterns to the dynamics of the motion system with which they are associated. Author (USGRDR)

N70-10199# Miami Univ., Fla.

HURRICANE TRITIUM 3: EVAPORATION OF SEAWATER IN HURRICANE FAITH 1966

H. Goete Oestlund May 1969 22 p refs
(Grants NSF GA-0415; NSF GA-1336; ESSA E-21-67(G), ESSA E-22-99-68(G))
(PB-184062; ML-69086) Avail: CFSTI CSCL 04B

Radial distribution of fusion bomb produced tritium, as HTO, has been measured in the inflow layer of hurricanes together with temperature, humidity and wind data. The tritium values are used to determine the rate of evaporation of seawater within the storm envelope. In FAITH, 28 August 1966, this evaporation amounted to 10% of the total water vapor budget inside 150 km radius. Radial distribution of evaporation rates and rainfall rates were obtained. Largest uncertainty in the results arises from the measurements of relative wind component. Author (USGRDR)

N70-10200# Weather Bureau, Silver Spring, Md. Equipment Development Lab.

WINDS ALOFT MEASUREMENTS THROUGH LORAN C NAVIGATION AID

Christos Harmantas Oct. 1968 35 p refs
(PB-183989; WBTM-EDL-6) Avail: CFSTI CSCL 04B

The feasibility of a new balloon-borne radiosonde tracking system for the determination of winds aloft was demonstrated. Flight tests showed the system to have higher resolution than the conventional radio-theodolite equipment. The new system can be used on land or at sea without the necessity for stabilized platforms and tracking antennas. The system makes use of existing long-range navigational aids which are telemetered from a conventional 403-MHz radiosonde modified for this application. Surface equipment separates the meteorological and navigation data, processing the latter to yield radiosonde displacement at desired time intervals. Typical wind speed and direction accuracies are believed to be better than plus or minus 1 meter per second in speed and plus or minus 5 degrees in direction. The system promises low cost in both expandable radiosonde and terminal equipment. AUTHOR (USGRDR)

N70-10205# National Environmental Satellite Center, Washington, D.C.

SOME ASPECTS OF THE VORTICITY STRUCTURE ASSOCIATED WITH EXTRATROPICAL CLOUD SYSTEMS

Harold J. Brodrick, Jr. May 1969 15 p refs
(PB-184178; ESSA-TM-NECTM-15) Avail: CFSTI CSCL 04B

Results are presented showing a relationship between stages of satellite-observed cloud-pattern development in extratropical cyclones and the associated 1,000-500-mb layer-mean vorticity maxima. The vorticity maxima increase in magnitude in early stages to reach the highest values in the mature stage of cloud pattern development, and their locations are essentially coincident with the center of cloud pattern organization throughout the development. Author (USGRDR)

N70-10247# Joint Publications Research Service, Washington, D.C.

METEOROLOGY

In its Soviet Bloc Res. In Geophys., Astronomy, and Space, No. 206 13 Jun. 1969 p 4–25 refs (See N70-10245 01-34)
Avail: CFSTI

Abstracts of recent meteorological publications are presented. Included are topics on magnetic storms, possibility of modifying the earth's climate, fog dispersion, problems in atmospheric physics, climatology for industrial growth, pressure anomalies over the Northern Hemisphere, and cloud seeding. A coordinated magnetic storm study of a solar flare by use of meteorological rockets is described. F.O.S.

N70-10255# Weather Bureau, Salt Lake City, Utah.

CLIMATE OF PHOENIX, ARIZONA

R. J. Schmidli, P. C. Kangieser, and R. S. Ingram Apr. 1969 62 p refs
(PB-184295; WBTM-WR-38) Avail: CFSTI CSCL 04B

The population and agricultural importance of the Phoenix, Arizona, area are expected to increase significantly over the next decade. Current projections are for the population in the area to grow to over a million people in the 1970's. The purpose of this publication is to provide data on the climate of Phoenix. Author (USGRDR)

N70-10281# Aerometric Research, Inc., Goleta, Calif.

CONTINUED RESEARCH ON DEVELOPING QUANTITATIVE PRECIPITATION FORECAST METHODS IN WESTERN AREAS Final Report

Einar L. Hovind, Robert D. Elliott, and Martin D. Hannemann May 1969 67 p refs
(Contracts ESSA-E127-68(N); CWB-11099)
(PB-184242) Avail: CFSTI CSCL 04B

A single station quantitative precipitation forecast (QPF) method has been developed for selected stations in the western region of the United States and for selection months during the winter-half of the year. The QPF method incorporates the mid-tropospheric vertical motion field and the 500 mb flow pattern in the prediction of the occurences and amounts of precipitation during 12-hourly periods subsequent to the initial synoptic charts. Specifically, the intersection point between the maximum upward vertical velocity, as computed with the present numerical weather prediction models, and the 500 mb jet stream, as approximated with the 5580m contour of that level, is used as a basic reference point in the QPF method. Author (USGRDR)

N70-10282# Weather Bureau, Salt Lake City, Utah.

UPPER-AIR LOWS OVER NORTHWESTERN UNITED STATES

A. L. Jacobson Apr. 1969 39 p refs
(PB-184296; WBTM-WR-39) Avail: CFSTI CSCL 04B

Meteorology is characterized by developments which are difficult

to forecast because they appear to depart from the common rules. The pattern discussed in this paper is one which appears frequently over northwestern United States during the warmer period of the year and occassionally over southern and central United States during the colder months. Considered in three dimensions, low-pressure centers slop upward toward cooler air aloft so that an imaginary nearly straight line joins the surface low center with its associated low centers at 700 and 500 millibars.
Author (USGRDR)

N70-10295# National Hurricane Research Lab., Miami, Fla.
EXPERIMENT IN FORECASTING HURRICANE DEVELOPMENT WITH REAL DATA
Banner I. Miller Apr. 1969 35 p refs
(PB-184238; ERLTM-NHRL-85) Avail: CFSTI CSCL 04B

A multi-level primitive equation model incorporating diabatic and frictional influences was developed for numerical weather prediction in the tropics. When tested on a limited geographical area in the Western Atlantic, the model appeared capable of predicting the development of a vortex similar to hurricane. Real data were used and a tropical cyclone did occur. Many typical features of hurricanes, such as the formation of an intense low level vortex, the warming of the upper troposphere, the development of an upper level anticyclone, low level inflow, and high level outflow were forecast.
Author (USGRDR)

N70-10303# Weather Bureau, Silver Spring, Md. Weather Analysis and Prediction Div.
SIZE OF TORNADO WARNING AREA WHEN ISSUED ON BASIS OF RADAR HOOK ECHO
Alexander Sadowski May 1969 35 p refs
(PB-184613; WBTM-FCST-10) Avail: CFSTI CSCL 04B

Documented radar hook echoes and storm data for the years 1953-1966 were studied for clues to improve the tornado warning service. In 29 out of 33 instances, for which data were adequate for comparison, tornadoes occurred near the distal end or knob of observed radar hook echoes. The diameter of a circle which best fits or describes a radar hook echo and the speed and direction of movement of the parent storm cell for one hour are used to determine the size and limits of the tornado warning area. The method is advanced as a proposal for reducing the size of the tornado warning area when issued on the basis of an observed radar hook echo.
Author (USGRDR)

N70-10310# Miami Univ., Fla. Institute of Marine Sciences.
ABSOLUTE IN FLIGHT CALIBRATION OF AIRBORNE HUMIDITY INSTRUMENTS
H. Goete Oestlund and Robert D. Stearns Jun. 1969 16 p refs
(Grant ESSA-E22-99-68(G))
(PB-184568; ML-69103) Avail: CFSTI CSCL 04B

During several flights in 1967 and 1968, measurements of absolute humidity were made by two or three of the following systems installed on the ESSA Research Flight Facility's DC-6 aircraft: (1) An infrared hygrometer (2) A frost point hygrometer (3) Molecular Sieve absorption traps. A brief description of these instruments is presented with emphasis on No. 3, in which a measured volume of air is stripped of its water which is weighed. The agreement between all systems was excellent, with deviations usually within 0.2gl cw m.
Author (USGRDR)

N70-10320*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TEMPERATURE, PRESSURE, DENSITY, AND WIND MEASUREMENTS IN THE STRATOSPHERE AND MESOPHERE, 1967
W. S. Smith, J. S. Theon, P. C. Swartz, J. F. Casey (Globe Exploration Co., Inc.), and J. J. Horvath (Mich. Univ., Ann Arbor) Washington Nov. 1969 87 p refs
(NASA-TR-R-316) Avail: CFSTI CSCL 04B

Complete data from a total of 39 rocket soundings conducted during 1967 from Wallops Island, Virginia; Churchill, Canada; Barrow, Alaska; and Natal, Brazil are presented. Temperature, pressure, density and wind profiles from 33 acoustic grenade experiments and temperature, pressure and density profiles from 6 pitot static tube experiments covering the altitude range of approximately 30 to 90 kilometers are tabulated. No attempt has been made to analyze the meteorological significance of these data here. An error analysis for each of the 33 acoustic grenade soundings has been included.
Author

N70-10528# Weather Bureau, Silver Spring, Md. Techniques Development Lab.
CHARTS GIVING STATION PRECIPITATION IN THE PLATEAU STATES FROM 850- AND 500-MILLIBAR LOWS DURING WINTER
August F. Korte, Donald L. Jorgensen, and William H. Klein Sep. 1969 86 p refs
(ESSA-TM-WBTM-TDL-25) Avail: CFSTI

Probabilities of precipitation from 850-mb and 500-mb lows are derived for selected stations in the intermountain West during winter. It is found that the precipitation generally appears to be best specified at the lower levels and by the most intense lows. Considerable variability is found between stations, partly as a result of differences in their elevation, surrounding topography, and latitude. The relative effectiveness of each level in specifying precipitation is illustrated for several stations with varying characteristics. The application of these charts as forecast aids is presented.
Author

N70-10573# Fleet Numerical Weather Facility, Monterey, Calif.
GENERAL ENVIRONMENTAL COMPUTER PRODUCTS CATALOG
Apr. 1969 48 p
(AD-691246; FNWC-TN-11) Avail: CFSTI CSCL 4/2

The number of requests for numerical environmental products received from users throughout the naval establishment is increasing. As more fleet units and shore stations become aware of what is available in the way of environmental support, the number of requests will increase even further, to enhance selection and to make a list of products available to all users, the following catalog of numerical products has been tabulated. The catalog 'numbers' list all basic fields for standard nedn areas (usually hemispheric). Formats and areas which are variations of basic field numbers are outlined in appendix a. Products are available from the nedn in four different formats: (1) computer prepared messages, (2) computer plotted charts (plotter instructions), (3) data fields (band index), (4) spot data format.
TAB

N70-10587# Interdepartmental Committee for Atmospheric Sciences, Washington, D.C.
NATIONAL ATMOSPHERIC SCIENCES PROGRAM: FISCAL YEAR 1970
Jan. 1969 63 p
(PB-184190; ICAS-13) Avail: CFSTI CSCL 04B

Contents: World weather program; Project Themis; Weather modification; Classification system ; Program summaries; Agency programs.
USGRDR

N70-10610# Fleet Numerical Weather Facility, Monterey, Calif.
MONTHLY COMBINED WAVE HEIGHT MEANS AND STANDARD DEVIATIONS AND COMBINED WAVE MEAN AND MODAL DIRECTIONS

Glenn D. Hamilton and Richard C. Corkrum May 1969 56 p
(AD-691247; TN-45) Avail: CFSTI CSCL 8/3

Numerical wave and swell analyses have been produced twice daily at Fleet Numerical Weather Central since 1961. The program was revised in 1965 and the output since 1965 has been used in this investigation. The wave and swell fields are routinely merged by a root-mean-square technique and provide combined wave height, direction, and period fields. The combined analyses, in gridded format on magnetic tape, have been used to compute monthly means and standard deviations of the wave height and modal and mean wave directions. The scheme of computation is described and the plotted charts are presented. Author (TAB)

N70-10624# Weather Bureau, Silver Spring, Md. Upper Air Branch.
MONTHLY MEAN 100-, 50-, 30-, AND 10-MILLIBAR CHARTS AND STANDARD DEVIATION MAPS, 1956-1967
Apr. 1969 126 p refs
(ESSA-TR-WB-11) Avail: SOD $1.25

Monthly mean analyses of temperature and geopotential height at the 100-, 50-, 30-, and 10-mb levels in chart form, together with maps of the standard deivations of daily values about the monthly means, are presented for 1956-1967. Brief descriptions of the automatic data processing and the computerized objective analysis procedures employed in the preparation of these charts and maps are also given. Author

N70-10630# National Meteorological Center, Suitland, Md.
ON A CERTAIN TYPE OF INTEGRATION ERROR IN NUMERICAL WEATHER PREDICTION MODELS
Hans Oekland Sep. 1969 27 p refs
(ESSA-TM-WBTM-NMC-45) Avail: CFSTI

Certain truncation errors occur in numerical weather prediction models when a grid-point representation of the variables is used to simulate advection phenomena. The errors are manifest by excessive values of the variables and by upstream propagation of small-scale noise. The mechanism causing these errors is studied by numerical experiments and harmonic analysis. Several ways to avoid or prevent errors of this kind are cited. Inclusion of a horizontal diffusion term in the scheme may be necessary to remove the errors completely. Author

N70-10658# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet Block Res. in Geophys., Astronomy, and Space, No. 204 14 May 1969 p 9-27 refs (See N70-10656 01-34)
Avail: CFSTI

The instrumentation and scientific program of the Cosmos 149 satellite are described, as well as the establishment of a weather satellite data acquisition station in Cuba and a rocket sounding station in Antarctica. Articles dealing with atmospheric turbulence and spectral bands; aerosol phenomena in various areas of the atmosphere; characteristics of the geopotential field, variations in wind conditions over geographical areas and at various heights; and sea ice observations are also briefly summarized. A.C.R.

N70-10759# Weather Wing (7th), Scott AFB, Ill.
WEATHER TERMINAL FORECAST PREPARATION
Bryan G. Falzgraf 25 Jul. 1969 10 p refs *Its* 7WW Pamphlet-105-8
(AD-692494) Avail: CFSTI CSCL 4/2

The report contains a discussion of the importance of systematic procedures to be followed in the preparation of a therminal forecast including recommendation of the use of a TAF Worksheet, description of the characteristics of a good worksheet and review of the steps followed in designing a worksheet followed by a sample copy. Author (TAB)

N70-10782# Fairchild Hiller Corp., Germantown, Md. Space and Electronics Systems Div.
REFRACTIVE INDEX SOUNDING SYSTEM (RISS) Final Report, Jan. 1967 - Sep. 1968
Joseph W. Spitzer Jan. 1969 168 p
(Contract F19628-67-C-0157)
(AD-691888; AFCRL-69-0054) Avail: CFSTI CSCL 4/2

The document describes the design, development, and test of a digital meteorological sounding system called the Refractive Index Sounding System (RISS). This system obtains meteorological data in the form of temperature, pressure, and humidity and digitizes this data for subsequent transmission over a High Frequency Radio Communications Link to a central computer site where the data is utilized for index of refraction (IOR) computations. A brief discussion is contained outlining the program purpose and requirements and a summary is included which describes the various changes in these requirements as the program evolved. The various equipments comprising the system are discussed in detail and a systems analysis is presented which discusses the various requirements and parameters necessary for an IOR determination. A systems error analysis is also included. System test data obtained during laboratory and field tests along with an evaluation of this data is included as a means of determining the systems capability and performance characteristics. A conclusion reached as a result of the text and evaluation of the system is that RISS met essentially all of the operational and performance requirements, but that the radiosonde sensors still need improvement. The sensors are the limiting factors in obtaining the desired IOR accuracy. Author (TAB)

N70-10789# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
A STUDY OF THE STRUCTURE AND BEHAVIOR OF JET STREAMS OVER THE WESTERN UNITED STATES
Peter F. Lester Jun. 1969 123 p refs
(Grant E-10-68(G))
(PB-185424) Avail: CFSTI CSCL 04B

It is suggested that satellite and conventional data should be combined to investigate the detailed structure of individual jet streams and that a large sample of maximum wind data should be statistically examined to reveal the climatological characteristics of jet streams near the mountains. Four case studies and a systematic sample of five years of maximum wind data for spring have been analyzed to test the proposed approach. Case study results quantitatively indicate that the jet stream environment is conducive to widespread lee wave activity. When wave clouds are present, their location and dimensions as observed by satellite appear to be related to the jet stream structure. The dimensions of terrain-induced clear areas in jet stream cirrus are also indicative of that structure. The maximum wind statistics for spring have isolated possible large scale, long term orographic effects on the jet stream. Author (USGRDR)

N70-10792# Stanford Research Inst., Menlo Park, Calif.
COMPARISON OF CLOUD MOTION VECTORS AND RAWINSONDE DATA Final Report
S. M. Serebreny, R. G. Hadfield, R. M. Trudeau, and E. J. Wiegman Jul. 1969 66 p
(Contract E-193-68)
(PB-185457) Avail: CFSTI CSCL 04B

The objective of the report was to correlate rawinsonde data with observed cloud motions, delineated through the use of an electronic system. If such cloud motions are indeed representative of the wind field, geostationary satellite cloud photographs would be of great value for analysis of data-sparse regions. Author (USGRDR)

N70-10817# Secretariat General a l'Aviation Civile, Paris (France).
CLIMATIC DATA FROM THE METEOROLOGICAL STATION DUMONT d'URVILLE [DONNEES CLIMATIQUES DE LA STATION DUMONT D'URVILLE]
J. Chesneau and J. Heuzey May 1969 68 p In FRENCH *Its* No. 72
Avail: CFSTI

Monthly measurements and statistical analysis of surface weather data from the Dumont d'Urville station in Terre Adelie, France are presented. The geographical location of the station, features of the recording equipment, standardization techniques for atmospheric pressure and temperature, and wind pressure measurements are described. Tables of daily, monthly, and average values include maximum sunshine levels, visibility and precipitation patterns, and the direction of prevailing atmospheric circulation. Average monthly values for diverse climatic features for the years 1950 to 1967 are recorded. Transl. by M.H.E.

N70-10838# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES. VOLUME 10: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET Final Report
Jun. 1969 32 p refs
(Contract FA-67-WAI-129)
(AD-691741; SRDS-RD-69-22-Vol-10) Avail: CFSTI CSCL 1/5

The report contains climatological data for Cleveland-Hopkins International Airport, Cleveland, Ohio. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Various weather and landing system categories are tabulated in most cases from 10 years of data, as aids for making decisions affecting landing systems and fog dissipation. Author (TAB)

N70-10840# National Environmental Satellite Center, Washington, D.C.
CHARACTERISTICS OF DIRECT SCANNING RADIOMETER DATA
Edward G. Albert Apr. 1969 8 p
(PB-183965; ESSA-TM-NESC-7-Suppl-1) Avail: CFSTI CSCL 22B

This supplement describes in greater detail the scanning radiometer data received directly by local stations from the improved TIROS satellite. USGRDR

N70-10875# Environmental Science Services Administration, Las Vegas, Nev. Air Resources Labs.
CLIMATOLOGICAL DATA NEVADA TEST SITE AND NUCLEAR DEVELOPMENT STATION
Ralph F. Quiring Aug. 1968 198 p Sponsored in part by AEC
(TID-24762; ESSA-ERLTM-ARL-7) Avail: CFSTI

Climatological data for the Nevada Test Site and Nuclear Rocket Development Station were compiled. The data and analyses are presented as samples from substantially different topographic environments to show the salient features of the seasonal and diurnal variations of wind and temperature near ground level and aloft. An evaluation of precipitation data for a 20-station network on the test site and a 5-yr climatological summary for the continuously manned Yucca weather station are included. Author (NSA)

N70-10893+ National Lending Library for Science and Technology, Boston Spa (England).
AN EXPERIMENTAL CRITICAL ANALYSIS OF AIR TEMPERATURE DATA ON A URAL-4 ELECTRONIC COMPUTER
T. P. Svetlova 1968 21 p refs Transl. into ENGLISH from Glav. Geofiz. Obs., Tr. (Leningrad), v. 230, 1968 p 8–18
(NLL-M-7646-(5828.4F) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A computer program of linear interpolation was used to analyze air temperature measurements from weather station networks in order to exclude the influence of special local features in the disposition of the station. The analysis consisted of the interpolation of temperatures of each station from data at the 8 nearest stations and the comparison of interpolated values with those actually measured. Statistical analysis of interpolation errors showed that 10% of the total number of cases exceeded the criterion for the rejection of data on monthly mean temperature when hand control was used. The exclusion of boundary stations greatly improved the results of interpolation. G.G.

N70-10899 National Lending Library for Science and Technology, Boston Spa (England).
THE CHARACTER OF THE VARIATION OF THE OVERALL CONTENT OF ATMOSPHERIC OZONE IN HIGH-LEVEL CYCLONES AND ANTICYCLONES
D. F. Harchilava [1969] 11 p refs Transl. into ENGLISH from Akad. Nauk, Mezhdunar Kom. po Prov. Mezhdunar. Geofiz. Goda, Geofiz. Byul. (Moscow), no. 17, 1966 p 63–68
(NLL-M-7654-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

The relationship between ozone and the upper atmospheric pressure field was studied at the 200 mb surface. Data from ozone measuring stations in Europe and Asia, including the USSR, and charts of the 200 and 300 mb levels were used. High level cyclones and anticyclones were chosen by considering only those pressure systems with closed contours in which there was located an ozone measuring station. It is concluded that: (1) In the Northern Hemisphere with high level cyclones there is a positive deviation of total ozone content, and in anticyclones a negative one. (2) The deviation of ozone content in high level systems has a seasonal variation, with the maximum in the spring, and the minimum in summer. F.O.S.

N70-11016# Aerospace Corp., El Segundo, Calif. Satellite Systems Div.
CLOUD-COVER RECURRENCE AND DIURNAL VARIATION, 1 OCTOBER 1966 – 1 MARCH 1969
Cyrus R. Mc Allister 30 Apr. 1969 59 p refs
(Contract F04701-68-C-0200)
(AD-691233; TR-0200(4520-05)-1; SAMSO-TR-69-211)

Estimators of conditional probabilities of recurrence of six-eighths or more cloud-cover, given a set of unconditional probabilities according to initial times, are presented and tested against a sample of northern hemispheric data. The estimators are shown to be highly efficient in the sense that more than 95% of the achieved estimates fall within plus or minus 0.02 of observed values of the conditional probabilities. A sensitivity analysis is presented to demonstrate that the methodology and results are essentially independent of particular data source with regard to geographic location, climatic regime, or season of the year insofar as parameter determination and concomitant accuracy of estimation are concerned. Extensions to broader classes of meteorological phenomena are also indicated. Author (TAB)

N70-11040# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ERRORS IN THE DETERMINATION OF WIND VELOCITY AND DIRECTION DUE TO INACCURATE MEASUREMENT OF COORDINATES
M. V. Krechmer 4 Jun. 1969 34 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 74, 1966 p 3–22
(AD-693279; FTD-MT-24-07-69) Avail: CFSTI CSCL 4/2

The author compares the principal methods of wind

measurement based on the determination of coordinates. The paper includes the following: the computational formulas for the direction of the wind and the displacement of the horizontal projection of the balloon between particular points, the equation for the three systems and the equation for the squares of the total errors of determination of angle and displacement; the general laws of radiowind observations; the influence of the horizontal angle; the comparison of the sounding systems; determination of the principal components of the general errors of wind measurements; special cases of wind measurement; the influence of systematic errors of the measurement of coordinates on the accuracy of determination of wind speed and direction; evaluation of the recommendations of the WMO on radar wind measurement; and effect of the earths curvature and refraction. TAB

N70-11041# Chicago Univ., Ill. Dept. of Geophysical Sciences.
GROWTH, MOTION AND CONCENTRATION OF PRECIPITATION PARTICLES IN CONVECTIVE STORMS
R. C. Srivastava and David Atlas 18 Nov. 1968 10 p refs Revised
(Grant NSF GA-919)
(PB-185559) Avail: CFSTI CSCL 04B

Analytical solutions for the growth and vertical and horizontal motion of a precipitation particle growing by coalescence with cloud drops are derived under simplified steady state assumptions. An equation is also developed for the concentration density of a continuous distribution of growing particles. Assuming that the cloud water content varies linearly with height, and that the fall speed of a drop is proportional to the square root of its diameter, it is shown that the combination of a linearly increasing updraft surmounted by a sharply decreasing one sets a sharp upper limit to the particle size, and sorts the particles horizontally. Particle size spectra computed from the concentration density equation are continuous and well-behaved for rising, floating, and falling particles alike. Author (USGRDR)

N70-11101# Weather Squadron (8th). Detachment 6. Pease AFB, N.H.
TERMINAL FORECAST REFERENCE FILE: PEASE AFB, N.H., VOLUME 1
Jul. 1969 111 p
(AD-692114) Avail: CFSTI CSCL 4/2

The report is a reference file for forecasters. It contains a description of the local area climatology, weather regimes, rules of thumb, and forecast studies. Author (TAB)

N70-11109# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES. VOLUME 32: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET Final Report
Jun. 1969 32 p refs
(Contract FA-67-WAI-129)
(SRDS-RD-69-22-vol-32) Avail: Issuing Activity

Tabular data are presented for use in evaluating the cost/benefits of all-weather landing systems and fog dissipation techniques. The time intervals of duration of the weather categories are significant in determining the times of the delay, diversion, or cancellation of an aircraft flight that result from a restricted weather category. This information, together with the number and types of aircraft affected by the restrictions and costs of delay, diversion, or cancellation, combine to provide the total costs resulting from weather disturbances. Climatological summaries are included for 41 airports. Author

N70-11119# Environmental Data Service, Silver Spring, Md.
ANGULAR DISTRIBUTION OF REFLECTED RADIATION ACCORDING TO THE DATA FROM IL-18 AIRCRAFTS IN 1964 [UGLOVOE RASPREDELENIE OTRAZHENNOI RADIATSII PO DANNYN POLETOV NA SAMOLETE IL-18 V 1964G]
A. I. German, M. G.Korobov, N . G. Markina, and L. A. Pakhomova Jun. 1969 30 p refs Transl. into ENGLISH from Tsentr. Aerol. Observ. (Russia), no. 70, 1966 p 3–22
(AD-692539; WB-T-114) Avail: CFSTI CSCL 4/1

A problem on the simultaneous examination of the cloud cover and radiation fields is presented. The techniques of flight experiments and processing of results of measured reflected shortwave radiation from different underlying surfaces and cloud formations is described using vertical aerial photography. The angular distribution of the luminance factor as well as the intensity of reflected radiation is presented in relationship with the properties of the characteristics of the underlying surface and the spatial structure of various cloud forms. Author (TAB)

N70-11138# Environmental Data Service, Silver Spring, Md. Techniques Development Lab.
COMPUTER FORECASTS OF MAXIMUM AND MINIMUM SURFACE TEMPERATURES
William H. Klein, Frank Lewis, and George P. Casely Oct. 1969 123 p refs
(ESSA-TM-WBTM-TDL-26) Avail: CFSTI

An automated system for predicting maximum and minimum surface temperatures for 12- to 60-hour projections is described. The system uses multiple regression equations derived for 131 cities in the United States and 12 in southern Canada from 18 years of daily data stratified by 2-month periods. The predictors are selected by screening upper level heights and thicknesses observed at 67 grid points in North America and surface temperatures observed at the network of 143 cities. On the average, about three-fourths of the temperature variance is explained by 4–5 variables, and the standard error of estimate is just over 4 F. Author

N70-11159 National Lending Library for Science and Technology, Boston Spa (England).
THE SYNOPTIC CONDITIONS IN WHICH A TROPICAL DEPRESSION AND A TROPICAL CYCLONE ORIGINATED IN THE INDIAN OCEAN IN MAY 1967
N. G. Davydova et al [1969] 9 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Cent. SSSR Gidromet. (Leningrad), no. 26, 1968 p 92–98
(NLL-M-7647-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

A brief survey of synoptic conditions in which a tropical depression and a tropical cyclone occurred in the Indian Ocean is given. Nephanalitic charts were used to follow the formation of cloud masses with vortex structures from the original poorly marked depression at the surface with two small centers to subsequent spiral belt appearances and finally to the cyclonic form. There was a well marked vortex in the center of the cloud mass when the tropical cyclone reached its greatest increase in the concentration of spiral belts. G.G.

N70-11200 National Lending Library for Science and Technology, Boston Spa (England).
ON THE ACCURACY OF INTERPOLATION IN THE CRITICAL ANALYSIS OF METEOROLOGICAL DATA
R. L. Kagan 11 Mar. 1969 11 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 230, 1968 p 48–52
(NLL-M-7645-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Linear interpolation was successfully performed on monthly mean observations from a meteorological network located in the plains. Calculations were carried out using the Ural 4 computer. Parameters analyzed were: wind speed, vapor pressure, relative humidity, precipitation levels, sunshine duration, cloud amount, air pressure, and temperature. E.C.

N70-11254 National Lending Library for Science and Technology, Boston Spa (England).
THE USE OF LINEAR INTERPOLATION TO CONTROL OBSERVATIONAL DATA
I. A. Berlin et al 4 Mar. 1969 12 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 230, 1968 p 3–7 (NLL-M-7644-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Computerized analytic methods for controlling average values of surface meteorological parameters are discussed. The methods are based on the theory of interpolation of stationary random functions. Application of the methods reveals that spatial linear interpolation is feasible for controlling average values of meteorological observations recorded at stations located in the plain regions. E.C.

N70-11284# General Electric Co., Ltd., Stanmore (England).
TECHNIQUES AND ERRORS OF BALLOON LOCATION BY LOW ORBIT METEOROLOGICAL SATELLITES
P. N. Denbigh Jul. 1969 21 p Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14–25 Jul. 1969
Avail: CFSTI

This paper discusses the use of terrestrial navigation schemes for balloon location, namely Omega, Loran C, and Transit and also active location techniques by the satellite itself, namely range-range, range-Doppler and Doppler-Doppler. The main emphasis of the paper is towards the geometric aspects of the active schemes, such as earth coverage, and the magnification of range error into a much greater location error. Balloon movement due to wind is shown to be a very important factor. Brief mention is made of other, non-geometric, effects and it is concluded that range-range provides the optimum overall solution. Author (ESRO)

N70-11288 Building Research Station, Watford (England).
INSTRUMENTATION AND ANALYSIS OF FULL-SCALE WIND PRESSURE MEASUREMENTS
K. J. Eaton and J. R. Mayne Feb. 1969 14 p refs Presented at Proc. of the Natl. Phys. Lab. Symp. on Instrumentation and Data Process. for Ind. Aerodyn., Teddington, Engl., 21–22 Nov. 1968 (CP1-69) Avail: Issuing Activity

A resume is given of the current research requirements for wind pressure measurements being carried out on two tall buildings in central London. A pressure transducer was developed for the program which gives an electrical output suitable for use in conjunction with standard types of commercial recording equipment. The installation of the equipment in the buildings is described. Multi-channel records are produced on ultraviolet-sensitive photographic paper which are processed and put into digital format. Several computer programs have been written to analyze the data to improve knowledge of the nature of wind loadings on buildings in an urban environment. Author

N70-11284# Atomic Energy Commission Research Establishment, Riso (Denmark). Physics Dept.
PHASE MIXING AND SPATIAL LANDAU DAMPING OF ION-ACOUSTIC WAVES
Per Nielsen Jul. 1969 33 p refs Sponsored by Tech. Univ. of Den.
(RISO-190) Avail: CFSTI

Experiments on the interaction between a biased grid and the upstream plasma of a single-ended Q-machine are described. It is found that the grid reflects some of the ions in the plasma flow. When exciting waves under these conditions, a phase velocity much higher than expected for the 'natural mode' of Landau's dispersion relation is found. The results may be explained by assuming the ions of the initial perturbation to be freely streaming. The Green function for ion-acoustic waves is calculated with different distribution functions. The results are compared with the results for freely streaming particles. It is found that an assumption of freely streaming particles is justified in the experiments described. In more general situations for the downstream plasma and in double-ended operation, there is no longer free streaming, but the shape of the Green function is always dependent on the distribution of the initial perturbation. Author (ESRO)

N70-11314# Hydronautics, Inc., Laurel, Md.
A CRITERION FOR DETERMINING AIR-FLOW SEPARATION FROM WIND WAVES
Jin Wu Apr. 1969 22 p refs
(Contract Nonr-3688(00))
(AD-691287; TR-231-25) Avail: CFSTI CSCL 4/2

Based on laboratory studies of wind-wave interactions, a criterion for determining air-flow separation from wind waves is proposed. The air separates from waves having a phase velocity less than the shear velocity, which characterizes the turbulent wind field. The successful application of this criterion to the analysis of oceanic data is herewith demonstrated. Author (TAB)

N70-11357 Meteorological Office (Gt. Britain).
THE MEASUREMENT OF UPPER WINDS BY MEANS OF PILOT BALLOONS
1968 41 p
(MET-O-804) Copyright. Avail: HMSO 4s 6d; BIS $1.00

Equipment used in balloon-borne upper wind measurement operations is described, and standard methods for determining balloon heights are reviewed. E.C.

N70-11360 National Lending Library for Science and Technology, Boston Spa (England).
A STUDY OF THE STRUCTURE OF AN AIR CURRENT AS A FACTOR IN THE TRANSFER OF PRODUCTS OF ATMOSPHERIC POLLUTION
P. A. Voroncov [1969] 36 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 207, 1968 p 138–154 (NLL-M-7655-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.

Airborne soundings were carried out to determine boundary layer characteristics in the lower atmosphere over two power stations. Recordings were made of the following parameters: horizontal and vertical components of microfluctuations of the wind, wind speed, air temperature, humidity, aircraft gust loads, and atmospheric pressure. Methods for calculating components of the turbulent energy balance in the boundary layer are discussed. E.C.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N70-10244*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A HARDWARE SIMULATION OF A LUNAR MIDCOURSE NAVIGATION SYSTEM USING STATISTICAL FILTER THEORY AND HAND-HELD SEXTANT OBSERVATIONS

Jay V. Christensen and Leonard A. Mc Gee Washington Nov. 1969 55 p refs
(NASA-TN-D-5528) Avail: CFSTI CSCL 17G

A simulation investigation is reported that considers the application of Kalman statistical filter theory and hand-held-sextant observations to lunar midcourse guidance and navigation. The specific system under investigation consisted of on-board guidance and navigation computations, a computer control and display system, and a hand-held sextant. An on-board digital computer was simulated using a ground-based digital computer, and the guidance and navigation computations were based on statistical filter theory and linear prediction. Symbolic abbreviation techniques were implemented in the control of the simulated on-board computer and to identify computer data. Observations of a simulated celestial scene were taken with a hand-held sextant which had been flown on the Gemini XII mission. The observer was a qualified Air Force navigator, and observations were taken under static conditions and under moving-planet and moving-cab conditions. Author

N70-10307# La Plata Univ. (Argentina).
A STUDY OF THE PARAMETERS FOR DESIGNING AUTOMATIC FLIGHT CONTROL SYSTEMS [ESTUDIO DE PARAMETROS DE DISENO DE SISTEMAS AUTOMATICOS DE CONTROL DE VUELO]
A. Hajduk and Carlos A. Zottig 1968 30 p In SPANISH /ts Publ. No. 94
Avail: CFSTI

The dynamic response of the complete controlled vehicle, and its flight system control system are presented, along with the basic principles of four distinct types of control systems. In the first type, it is assumed that the principal signal for correction is delivered to a free gyroscope. This signal and others from other elements of the circuits for realignment, which form the signals for correction, are applied to the servomotors which activate the control surfaces for displacement. The other systems analyzed are an improved system for positioning, a system for realignment, and a derived system. Transl. by F.O.S.

N70-10375# Lockheed Missiles and Space Co., Palo Alto, Calif.
NAVIGATION IN SPACE: OPERATION OF THE COMMAND-MEASUREMENT COMPLEX
Am. Aleksandrov et al 1969 4 p Transl. into ENGLISH from Pravda (Moscow), no. 307(18720), 3 Nov. 1969
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The ground command-measurement complex including its fundamental problems are discussed. The advantages for ground control are considered to be: (1) a continuous check on performance, (2) capability of correcting flight programs, (3) capability of changing or facilitating conditions for systems, and (4) assessment of results and data during flight. The definition of the command complex is given as that whole set of units and services which is utilized to assure flight control and utilization of space vehicles. Problems in maintaining spacecraft control are reviewed. F.O.S.

N70-11051# Lockheed Missiles and Space Co., Palo Alto, Calif.
BEHAVIOR OF A GYROCOMPASS IN THE FORM OF TWO ANGULAR VELOCITY INTEGRATORS DURING ROLLING
Iu. I. Rabionovich 1969 4 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Tverdogo Tela (USSR), no. 4, 1969 p 48–51
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The motion of a gyrocompass representing two angular velocity integrators mounted on the deck of a ship and interconnected by correction amplifiers is studied. The direction of the sensing axes of one of the integrators coincides with the East–West direction, and the other with the direction of the local vertical in the nominal mode of the gyrocompass for zero readings. The readings of the integrators are proportional to projection integrals of the absolute angular velocity on the sensing axes, and to integrals of the amplifier correction signals. These readings characterize the deviation of the base from the horizon plane and from the direction of the north. Integral equations are constructed to calculate the various angular motions of the gyrocompass platform. R.B.

N70-11103*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
ANALYSIS AND EVALUATION OF A NOVEL INERTIAL NAVIGATION SYSTEM
Edmund J. Koenke Washington Nov. 1969 54 p refs
(NASA-TN-D-5456; C-79) Avail: CFSTI CSCL 17G

A novel inertial navigation system referred to in the literature as the RAMP inertial navigator is analyzed and then compared to a conventional local vertical navigation system. The main attraction of this system is that it is capable of indicating the vertical using only gyros as sensors. The theory of the system mechanization is developed from first principles and methods for calculation of the system loop gains are presented. First, a single axis system is considered and then the analysis is generalized to a three axis system. The analyses performed indicate that error propagation for the novel system and the conventional system are identical for identical error sources. It is also shown that the RAMP base motion isolation system provides a better gyro environment than that used in a conventional system since the level gyros are not required in the gimbal servo loops. Reports of flight tests of this system corroborate these conclusions. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N70-10079# California Univ., Livermore. Lawrence Radiation Lab.
TESTS OF A FAIL-SAFE VACUUM BEAM LINE USING ACOUSTIC DELAY AND A FAST-CLOSING VALVE
Richard C. Wolgast and James W. Davis 27 Feb. 1969 4 p refs Presented at Natl. Particle Accelerator Conf., Washington, D.C., 5–7 Mar. 1969
(Contract W-7405-eng-48)
(PB-183832; UCRL-7405-eng-48) Avail: CFSTI CSCL 20G

An operational fail-safe line would consist of the following elements, listed in order of appearance as one proceeds from the beam exit foil window toward the accelerator: (1) pressure-rise detector; (2) acoustic-delay section; (3) fast-closing valve; and (4) straight-through liquid nitrogen trap, isolated by bakeable vacuum valves. Because of the thermal velocity distribution in the entering gas, it is practically impossible to stop all of it by the fast valve. The trap, however, will be effective in catching contaminants if the flow through the trap is well within the molecular flow regime at all times. The purpose of these tests is to ensure that this condition can be realized in a practical way. Author (USGRDR)

N70-10202# Battelle Memorial Inst., Columbus, Ohio.
PROGRESS ON DEVELOPMENT OF MATERIALS AND TECHNOLOGY FOR ADVANCED REACTORS Quarterly Report, Oct. – Dec. 1968
Donald L. Keller Jan. 1969 106 p refs
(Contract W-7405-eng-92)
(BMI-1857) Avail: CFSTI

Progress is reported in a program to determine the effects of radiation on various reactor cladding and structural materials and to characterize the embrittlement observed in cladding materials for liquid metal fast breeder reactors (LMFBR). Creep of LMFBR fuel materials is reported including the design, fabrication, and operation of the in-pile creep capsule. Efforts devoted to fabrication, preirradiation compressive creep testing, and mechanisms of creep of UO2 and UO2–PuO2 are reported along with results of creep testing of UO2 and post irradiation compressive creep testing of UO2 and UO2–PuO2. Investigations are reported on stoichiometry of UO2–PuO2. Sintering UN–PuN fuels; vaporization of PuN and UN–PuN alloys; nitride diffusion; UN–PuN compatibility with cladding and coolant materials; sodium wetting of nitride fuels and cladding materials; fabrication, cladding, irradiation, and evaluation of nitride fuels, and nitride pellet fuels for the EBR-II were also studied. Author

N70-10217 National Lending Library for Science and Technology, Boston Spa (England).
CARBON TRANSFER IN THE THTR AND AVR HIGH-TEMPERATURE REACTORS
E. Stolz and F. L. Werner 19 Jun. 1969 15 p refs Transl. into ENGLISH from Atomwirtsch. Atomtech (Duesseldorf), v. 13, no. 2, Feb. 1968 p 99–103
(NLL-CE-Trans-5154-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The chemical reactions leading to graphite corrosion by H2O, CO2, and O2, the reaction kinetics, integral core corrosion rate and carbon deposition are presented. The gas cleaning installation must reduce corrosion and prevent carbon deposition; the optimum combination of these two tasks is discussed. Author

N70-10253# European Atomic Energy Community, Geel (Belgium). Central Bureau for Nuclear Measurements.
EURATOM WORKING GROUP ON REACTOR DOSIMETRY Progress Report, Jul. 1964–Jun. 1968
U. Farinelli and M. Coppola 1969 26 p refs
(EUR-4386-e) Avail: CFSTI

Intergovernmental and research activities are summarized in the areas of relations with other organizations, detector cross sections, standardization and absolute measurements, the definition of errors, fast neutron measurements, intermediate and epithermal neutron spectra measurements; monitoring integrated thermal neutron fluxes, radiation damage investigations, fuel irradiation and burn-up evaluation, beta and gamma activity measurements, and reactor dosimetry applications to other systems. This period was marked by procedural improvements, the continuous and effective exchange of information and experience, and the adoption of more uniform methods. Recommendations for the increased effectiveness of the Working Group are made. A list of 159 papers is included. M.H.E.

N70-10287# United Kingdom Atomic Energy Authority, Dounreay (Scotland). Experimental Reactor Establishment.
SAFETY PROBLEMS WITH SINGLE WALL SODIUM/WATER HEAT EXCHANGERS FOR FAST REACTORS
V. M. Poplavskii et al [1969] 16 p refs Transl. into ENGLISH of Russian conf. paper Presented at Intern. Conf. on the Safety of Fast Reactors, Aix-en-Provence, France, 19–22 Sep. 1967
(CONF-670916-4; Trans-322) Avail: AEC Depository Libraries

The safety problems involved in the use of Na and H2O liquid–liquid heat exchangers for liquid Na-cooled fast reactors are analyzed. Experimental injections of H2O into liquid Na were performed to study: effect of shock; hydrodynamic phenomena in the loop; effect of the hydraulic characteristics of the loop on structural overloading; thermal effects of the reaction; efficiency of the reaction product evaluation system; and deformation and deterioration of the structural components. NSA

N70-10291# Institutt for Atomenergi, Kjeller (Norway).
FROST: A TWO-DIMENSIONAL FEW GROUP NEUTRON DIFFUSION CODE
K. Andrzejewski Feb. 1969 30 p
(PB-183863; KR-133) Avail: CFSTI CSCL 18K

The report gives a complete description of the few-group, two-dimensional diffusion theory code FROST, coded in FORTRAN 63 for the CD 3600 computer. The difference equations in FROST are in usual form, but the numerical method for solving them is rather new and is referred to as reconditioning method. FROST is designed for diffusion theory calculations of BWR square fuel assemblies in 5 energy groups. More than one thermal group is permitted. Author (USGRDR)

N70-10317# Swedish Cellulose Co., Sundsvall (Sweden). Research Lab.
COMPUTER EVALUATION OF TRACER INVESTIGATIONS ON SYSTEMS, WHEN OUTPUT FLOW IS RECIRCULATED TO THE INLET
Tor Sjoestedt Royal Swedish Acad. of Eng. Sci., Stockholm 1969 22 p refs *Its* Math. and Computing Machinery Series No. 17
(PB-184634; APS-MA-17) Avail: CFSTI CSCL 18B

Radioactive tracers are often used for determination of the residence time distribution for material flow through a system. When a fraction or all of the output flow is recirculated to the inlet, the residence time distribution must be computed from the recorded concentration-vs.-time curve at the outlet. The required equation for doing this is derived, and numerical calculations based on the derived formula are discussed and illustrated. Equations are also derived, which permit calculation of the moments of the residence time distribution from parameters taken from the recorded tracer concentration. Author (USGRDR)

N70-10400 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF THE SWELLING OF URANIUM ALLOYS UNDER IRRADIATION
J. Lehmann 1968 32 p refs Transl. into ENGLISH from J. Nucl. Mater. (Amsterdam), v. 27, 1968 p 285–309
(NLL-CE-Trans-5125-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

This study of the swelling of uranium under irradiation was carried out on small samples under controlled temperature and pressure conditions. The first experimental results for the alloys sicral F1, sicral F2, U-Mo 1.1 and U-Mo-Al-Sn are described. The degree of swelling determined by density measurement shows a very pronounced maximum between 450 and 550 C from the beginning of irradiation: 500 MWd/t. A hydrostatic pressure of 40 bar considerably reduces the swelling by a factor of 2 to 4 according to the kind of alloy. This effect seems to be particularly pronounced in the case of U-Mo-Al-Sn. The swelling maximum is due to the influence of the internal stresses by anisotropic growth of the grains. An attempt is made to explain the mechanisms based essentially on observations with electron microscope. The suggested explanations are homogeneous germination of gas bubbles in the metal and growth of the bubbles by diffusion of vacancies within the grains subject to tensile stress. Author

N70-10469# Naval Research Lab., Washington, D.C. Metallurgy Div.
DAMAGE-FUNCTION ANALYSIS OF NEUTRON-ENERGY AND SPECTRUM EFFECTS UPON THE RADIATION EMBRITTLEMENT OF STEELS
C. Z. Serpan, Jr. and W. N. Mc Elroy (Battelle Memorial Inst., Richland, Wash.) 26 Jul. 1969 20 p refs
(AD-692072; NRL-6925) Avail: CFSTI CSCL 18/8

The report presents the results of a new, comprehensive set of experimental data conforming to the irradiation conditions of the derived damage function (material, temperature, and fluence). The results of this experiment are discussed in terms of their establishing the validity of the damage function. Averaged values of the damage function are tabulated for a typical reactor physics calculation energy group structure, and their application to two different spectra is described. Finally, the damage-function fluences required to cause a 200F Delta-TT in A302-B steel are presented for many different reactor locations. For each of the spectra involved, the upper and lower energy limits of significantly damaging neutrons are given, and some detail is also provided regarding the contribution of subgroups within the overall energy spectrum. Author (TAB)

N70-10492# Union Carbide Corp., Oak Ridge, Tenn. Computing Technology Center.

DEVELOPMENT OF TWO-DIMENSIONAL DISCRETE ORDINATES TRANSPORT THEORY FOR RADIATION SHIELDING

F. R. Mynatt, F. J. Muckenthaler, and P. N. Stevens 11 Aug. 1969 211 p refs

(Contract W-7405-eng-76)

(AD-692168; CTC-INF-952) Avail: CFSTI CSCL 18/6

The purpose of the study is to extend the capabilities of the two-dimensional discrete ordinates method in order to provide accurate calculations for deep-penetration radiation transport problems. The basic method is generalized and improved, a complete technique for application is developed, and a comprehensive comparison with experiment is performed. Author (TAB)

N70-10566# Naval Postgraduate School, Monterey, Calif.

SIMULATION OF A LIQUID METAL FAST BREEDER REACTOR ON A HYBRID COMPUTER

Charles Lee Keller (M.S. Thesis) Jun. 1969 85 p refs

(AD-692446) Avail: CFSTI CSCL 18/11

A Liquid Metal Fast Breeder Reactor is simulated on a hybrid computer to study the transient behavior of the neutron density during a controlled reactivity input disturbance. The nonlinear partial differential equations of heat flow are reduced by a discrete space-continuous time method to ordinary nonlinear differential equations which are readily solved on the analog computer. Use is made of time multiplexing of the analog circuitry in order to reduce the number of components. An open-loop iteration process is employed to solve the closed-loop feedback system. Recently conducted research with the open-loop iteration method has demonstrated that a large number of iterations are required for convergence. An algorithm is developed which gives an improvement in the convergence rate for early values of time. For times greater than two seconds a stability problem with the converged solution was encountered and is discussed with some observations and comments. Innovations are introduced in the simulation of the neutron kinetics equations and in the handling of the nonlinear thermal properties of the uranium oxide fuel. Author (TAB)

N70-10748# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.

ULTRASONICALLY INDUCED SODIUM SUPERHEAT

Robert Eric Nystrom (Ph.D. Thesis) May 1969 225 p refs

(Grant NSF GK-1889)

(PB-184134; Rept-01357-8-T) Avail: CFSTI CSCL 18J

The objective of the investigation is to obtain data on the behavior of liquid sodium under conditions which may be encountered when sodium is used as a coolant in a fast breeder nuclear reactor. An experiment was designed to determine the amount of superheat required to produce nucleate boiling in liquid sodium both as a function of the heating rate and as a function of the temperature of the liquid sodium. USGRDR

N70-10750# Institutt for Atomenergi, Kjeller (Norway).

RAMONA 1: A FORTRAN CODE FOR TRANSIENT ANALYSIS OF BOILING WATER REACTORS AND BOILING LOOPS

P. Bakstad and K. O. Solberg Nov. 1968 156 p refs

(PB-185277; KR-135) Avail: CFSTI CSCL 18I

A boiling water reactor dynamics code RAMONA I is described. The code calculates the space-time behavior of a boiling water reactor or an electrically heated loop for several disturbances which may be chosen by the user. By numerical Laplace transform, transfer functions may be calculated to facilitate frequency domain studies. The report contains a detailed description of the code, input and output, and sample calculations. Author (USGRDR)

N70-10763# Institutt for Atomenergi, Kjeller (Norway).

MEASUREMENT OF THERMAL SPECTRAL INDICES IN REACTOR CELLS NEAR PLANE ABSORBERS

S. E. Wennemo-Hanssen 1969 51 p Sponsored by Reactor Centrum Nederland/AEC

(PB-185267; KR-136) Avail: CFSTI CSCL 18K

Thermal spectrum effects of plane boron-steel absorbers, covering a wide range of optical thicknesses, were studied in the Uranium dioxide/water zero power assembly NORA. An integral spectrum property was determined in terms of a spectrum index defined by the activation ratio of the isotopes Lu176 and Dy164. In the experiments the spatial variation of the spectrum index was measured using a foil technique. The Monte Carlo code MONTROSA was used for interpretation of the experimental results. MONTROSA calculates the spatial distribution of the thermal neutron spectrum, based on the Brown–St. John energy transfer model, in unit cells bounded by plane absorbers. Author (USGRDR)

N70-10766*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INVESTIGATION OF MERCURY-FLOW RAMP RATES FOR STARTUP OF THE SNAP-8 SYSTEM

Roy A. Lottig and Ronald H. Soeder 26 Sep. 1969 112 p refs

(NASA-TM-X-52689) Avail: CFSTI CSCL 18K

A critical parameter in the startup of the SNAP 8 system is the rate at which the mercury flow is brought up to the level required to make the system self-sustaining. Startup tests were conducted in which the duration of the flow ramp from 0 to 6600 pounds mass per hour (3000 kg/hr) was varied from 30 to 145 seconds. It was concluded that for the flight-type system a 100-second ramp was a good compromise between a ramp that was too short, precluding use of open-loop flow control, and a ramp that was too long, causing marginal acceleration of the turboalternator. Author

N70-10780# General Electric Co., Sunnyvale, Calif. Advanced Products Operation.

SODIUM-COOLED REACTORS FAST CERAMIC REACTOR DEVELOPMENT PROGRAM Quarterly Report, Aug.–Oct. 1968

Nov. 1968 120 p refs

(Contract AT(04-3)-189)

(GEAP-5700; QR-28) Avail: CFSTI

Progress is reported for analytical and experimental efforts directed toward the development of fast reactors using ceramic fuels, particularly mixed plutonium uranium oxide. Tasks discussed are: defected fuel behavior, safety experimentation, fuel performance, integral fast flux irradiations, core neutronics, thermal hydraulics, cladding, and safety analysis. E.C.

N70-10805# Douglas United Nuclear, Inc., Richland, Wash. Engineering Section.
DECONTAMINATION OF N-REACTOR STAINLESS STEEL STEAM GENERATORS
W. D. Bainard 11 Nov. 1968 12 p Presented at 25th Ann. Conf. of the Natl. Assoc. of Corrosion Engr., Houston, Tex.
(DUN-SA-74; CONF-690304-1) Avail: CFSTI

Decontamination processes and solutions used on the N reactor Type 304 stainless steel-tubed steam generators to remove the radioactive corrosion film prior to returing are presented. NSA

N70-10824# Commissariat a L'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
CASTOR AND POLLUX: SHIELDED CELLS FOR STUDYING FUEL TREATMENT PROCESSES [CASTOR ET POLLUX: CHAINES BLINDEES D'ETUDES DE PROCEDES DE TRAITEMENT DE COMBUSTIBLES]
Gerard Faudot and Andre Bathellier Jun 1969 58 p refs In FRENCH; ENGLISH summary
(CEA-R-3840) Avail: CFSTI

Castor and Pollux, two alpha, beta, gamma cells are described. They are designed for improvement studies of the various aqueous separation processes used in irradiated fuel reprocessing plants. Located in the same air-tight steel encasement, they are interconnected by a pneumatic transfer. These two cells have a similar in-line conception and they include: (1) a gamma shielding in lead of 10 cm. of thickness; (2) an inner air-tight box, made with stainless steel and plexiglas, is maintained in lowering in comparison to room pressure. Eleven Hobson master-slave manipulators allow inner manipulations. The inner equipment is briefly described. Author (ESRO)

N70-10858# Army Foreign Science and Technology Center, Washington, D.C.
COMPENSATING THE REACTIVITY OF NUCLEAR REACTORS WITH THE HELP OF LAYERED COMBUSTIBLE ABSORBENTS
V. N. Artamkin et al 1969 13 p refs Transl. into ENGLISH from Atomnaya Energ. (Moscow), v. 22, no. 3, 1967 p 215–218
(AD-692631; FSTC-HT-23-486-68) Avail: CFSTI CSCL 18/10

The article discusses the possibility of using layered combustible absorbents to compensate the reactivity of nuclear reactors. A method is proposed which makes it possible, in an P sub 1-approximation of neutron distribution outside an absorbent having no scattering, to calculate the space-time distribution of the absorbing material in a plane, combustible absorbent consisting of several layers of mixed materials. TAB

N70-10862# Southern Nuclear Engineering, Inc., Dunedin, Fla.
INVESTIGATION OF THE USE OF AQUEOUS SOLUTIONS AS EMERGENCY COOLANTS Quarterly Report
C. Rogers Mc Cullough, Gilbert M. Brown, and R. P. Hancock 1 Oct. 1968 48 p
(Contract AT(40-1)-3749)
(SNE-46; QR-3) Avail: CFSTI

Results of screening tests on emergency coolant additives are given. Selection of sodium perborate for single rod-heated enclosure tests is discussed. Single rod-heater test apparatus is described; test results using these assemblies are shown graphically. Multi-rod test equipment is described. NSA

N70-10868# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
PROTECTION OF ZIRCONIUM AND ITS ALLOYS BY METALLIC COATINGS
Henri Loriers, Alain Lafon, Raymond Darras, and Pierre Baque Oct. 1968 33 p refs In FRENCH Presented at intern. meeting on Corrosion, Paris, 27 May 1968
(CEA-Conf-1052; CEA-R-3612; Conf-680539-3) Avail: AEC Depository Libraries

Metallic coatings to protect Zr and Zr-alloy fuel cladding at 600 C in a CO2 environment were tested. Coatings of Al and Cu proved to be unsatisfactory. However, chromium and molybdenum coatings produced desired effectiveness and film adherence to the zirconium. NSA

N70-11118# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).
FAST REACTOR FUELS AT THE KARLSRUHE FACILITY IN GERMANY
Robert E. Macherey Nov. 1968 7 p
(TID-24855; MR-49) Avail: CFSTI

Irradiation operations in the FR-2 reactor are described. Burnup performances of UO2 and PuO2–UO2 fuel assemblies are discussed. The irradiation of PuO2–UO2 fuel assemblies in the BR-2 reactor is described. The performances of Mol 1, Mol 2, and Mol 3 specimens in the BR-2 reactor are also described. Author (NSA)

N70-11120# Bettis Atomic Power Lab., Pittsburgh, Pa.
VOID FRACTION AND RESIDUAL WATER PREDICTIONS DURING LOSS OF COOLANT
J. A. Redfield and J. H. Murphy Sep. 1968 12 p refs Presented at Intern. Conf. on the Constructive Uses of Atomic Energy, Washington, D.C.
(Contract AT(11-1)-GEN-14)
(WAPD-T-2155; Conf-681101-12) Avail: CFSTI

A modification to the FLASH program bubble rise velocity model is presented which produces an increased capability to describe void fraction experiments and residual water measurements after blowdown tests. The modified model shows an improved capability to describe LOFT semiscale blowdown tests over the full range. Author (NSA)

N70-11179*# National Aeronautics and Space Administration, Washington, D.C.
ELECTRIC PROPULSION MISSION ANALYSIS: TERMINOLOGY AND NOMENCLATURE
1969 15 p
(NASA-SP-210) Avail: CFSTI 21F

In establishing a set of system parameters for use in mission studies, it is first necessary to define a consistent set of terms and basic relations for reference. Since many groups perform such studies, and since electric propulsion hardware development is intimately associated with software development and mission design, it is prudent to agree on a common terminology. What is attempted here is the formulation of one such language. Author

N70-11197# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
RESEARCH AND DEVELOPMENT SAFETY
H. C. Hoy 28 Oct. 1968 7 p Presented at the Natl. Safety Conf., Chicago, 1968
(Contract AEC W-7405-eng-26)
(Y-OA-212) Avail: CFSTI

The problem of health and safety in research and development is considered. The code of ethics for engineers is discussed. NSA

N70-11207# Oak Ridge National Lab., Tenn. Radiation Shielding Information Center.
COMPILATION OF DATA ON EXPERIMENTAL SHIELDING FACILITIES AND TESTS OF SHIELDS OF OPERATING REACTORS

Nov. 1968 164 p refs Prepared in part by European Nucl. Energy Agency. European-Am. Comm. on Reactor Phys.
(Contract W-7405-eng-26)
(ORNL-RSIC-24; EACRP-U-37) Avail: CFSTI

Data are presented on radiation shielding experimental facilities and reactor shield tests in European Nuclear Energy Agency countries, including Japan and the United States. These data were collected by means of questionnaires by the European American Committee on Reactor Physics and edited by the Radiation Shielding Information Center. Additional data on Soviet facilities are included. Author (NSA)

N70-11208# Oak Ridge National Lab., Tenn.
IRRADIATION BEHAVIOR OF CLADDING AND STRUCTURAL MATERIALS
J. R. Weir, J. O. Stiegler, and E. E. Bloom Sep. 1968 49 p refs Presented at Am. Nucl. Soc. Natl. Topical Meeting, Cincinnati, 2 -4 Apr. 1968 Submitted for publication
(Contract W-7405-eng-26)
(ORNL-TM-2258; Conf-680419-4) Avail: CFSTI

The effects of irradiation on the mechanical and physical properties of materials to be used as cladding and structural components in fast reactors are of great interest to the reactor designer. The general aspects of the problem are discussed in terms of the observed changes in properties and microstructure and the possible mechanisms that might explain the observed effects. The discussion is concerned primarily with the austenitic stainless steels and with changes in mechanical properties which occur at test temperatures near the irradiation temperatures. For convenience the problem is divided into three ranges of irradiation temperature: low temperatures, intermediate temperatures, and high temperatures. On the basis of data presently available the damage appears to be significantly different for each temperature range. Author (NSA)

N70-11289# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
FAST REACTOR STUDIES, AUGUST - OCTOBER 1968
Stanley J. Stachura Oct. 1968 33 p Sponsored by AEC-EURATOM
(TID-24857; Rept-14) Avail: CFSTI

Topics discussed include: safety studies with Cabri coolant-loss flow experiments, fission product transport, and Na fires; thermal and mechanical studies with loop descriptions and safety-related experiments; Rapsodie control rod experience; and evaluation of Pu alpha and comparison of B and Ta control materials. NSA

N70-11313# RAND Corp., Santa Monica, Calif.
THE FEASIBILITY OF THE GASEOUS-CORE NUCLEAR REACTOR FOR ELECTRIC-POWER GENERATION
E. C. Gritton and B. Pinkel Jun. 1969 73 p refs
(Contract F44620-67-C-0045)
(AD-692113; RM-5721-PR) Avail: CFSTI CSCL 18/12

An examination of the potential of the gaseous-core nuclear reactor as a means of generating electric power. An analysis of the radiation-heat-transfer process in the core of a gaseous-core power-production reactor is combined with an estimate of the quantity of uranium required for criticality to determine the core pressure and temperature for various values of power generation and core diameters, with varying assumptions as to the effect of ionization of the fissile gas and the uncertainty of the Rosseland mean opacity. Even under the most unfavorable assumptions, attractive power levels can be obtained in reactors of practical size at gas pressures and wall temperatures that present structural materials can contain. The extreme operating endurance and high power densities of the power system make it attractive for space as well as terrestrial power generation. Author (TAB)

N70-11323# Atomic Power Development Associates, Inc., Detroit, Mich.
AEC-SPONSORED ACTIVITIES Quarterly Technical Progress Report, Jul. - Sep. 1968
Sep. 1968 34 p ref
(Contract AT(11-1)-865)
(APDA-232) Avail: CFSTI

The wastage effects of the sodium water reaction on tubes of Croloy, Incoloy 800, and stainless steel are investigated. An operating experience compilation for the Fermi fast breeder reactor is being formulated. A rhometer is evaluated for oxygen determination in sodium and wastage effects on steam generator tubes of the sodium reaction with water are determined. G.G.

N70-11398*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POSTIRRADIATION ANALYSIS OF HIGH-TEMPERATURE, LOW-BURNUP TUNGSTEN-URANIUM DIOXIDE TEST PLATES
Lauren L. Ball and Dean W. Sheibley Washington Nov. 1969 11 p refs
(NASA-TM-X-1872) Avail: CFSTI CSCL 18J

Problems in determining fuel burnup of high temperature tungsten - uranium dioxide fuel plates were resolved by using tungsten 184 as a thermal flux monitor. Methods for determining fission product releases from fueled test plates were evaluated. The use of fission product cesium 137 as a burnup monitor was also evaluated. Author

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N70-10061# United Kingdom Atomic Energy Authority, Abingdon (England). Culham Lab.
PROPERTIES OF LINEAR FILAMENTARY MULTIPOLE MAGNETIC FIELDS
G. D. Hobbs and J. B. Taylor Apr. 1968 24 p refs
(CLM-R-95) Avail: CFSTI; UK 3s 0d

A catalogue of the properties of the vacuum magnetic fields generated by a class of linear multipoles is presented. Author (NSA)

N70-10078# Mississippi State Univ., State College. Dept. of Physics.
STUDIES IN ELECTROMAGNETIC FIELD THEORY RELATED TO ORDNANCE HAZARDS Final Report
Clayborne D. Taylor 15 Nov. 1968 117 p refs Sponsored by AEC Prepared for Sandia, Corp., Albuquerque, N. Mex.
(PB-183634; SC-CR-68-3812) Avail: CFSTI CSCL 19A

Contents: Electromagnetic pulse generation by an impedance loaded dipole antenna; Electromagnetic pulse excitation of a perfectly conducting cylinder in a lossy medium; Penetration of electromagnetic fields through a small aperture into a cavity; Electromagnetic scattering in time varying, inhomogeneous media; Electromagnetic scattering from arbitrary configurations of wires. USGRDR

N70-10113 Princeton Univ., N.J.
OPTICAL REFLECTANCE STUDIES OF SILVER FOILS IN THE WAVELENGTH RANGE 3000 TO 6000 ANGSTROM
Stephen Newell Jasperson (Ph.D. Thesis) 1968 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-3297

This thesis reports the observation and identification of the surface plasmon mode in thick, vacuum deposited Ag foils using optical reflectance measurements. Several possible photon-surface plasmom coupling mechanisms are investigated experimentally, and evidence is presented which shows the dominant mechanism to be roughness of the foil surface. A new ellipsometric technique, especially well suited to the study of high reflectivity metals, is developed and used to measure the dielectric constants of Ag in the wavelength range, 3000 to 6000 A. The results are compared to data obtained by other authors. In addition, the relative sensitivity and versatility of this and several other presently used techniques are compared in the high reflectivity limit. Dissert. Abstr.

N70-10119 California Univ., Los Angeles.
RESONANCE WAVELENGTH SCATTERING BY A LANDAU-LIFSHITZ COMPOSITE FERRITE CYLINDER
Dennis Lloyd Gish (Ph.D. Thesis) 1968 321 p refs
Avail: Univ. Microfilms: HC $14.65/Microfilm $4.15 Order No. 69-7243

The problem considered is that of determining the scattered field of an incoming plane wave impinging upon a composite ferrite cylinder consisting of a ferrite sheath of radius b and an infinite conducting metal core of radius a. The properties of the ferrite are described by the Landau – Lifshitz relaxation damping model. Dissert. Abstr.

N70-10258# Catholic Univ. of America, Washington, D.C. School of Engineering and Architecture.
OPTICAL ANALYSIS OF VIBRATIONS IN CONTINUOUS MEDIA
J. A. Clark and A. J. Durelli Jun. 1969 37 p refs ONR Struct. Mech. rept. no. 20
(Contract Nonr-2249(06))
(AD-691260; THEMIS-ONR-69-5) Avail: CFSTI CSCL 20/11

Optical methods of vibration analysis are described which are independent of assumptions associated with theories of wave propagation. The principles involved are reviewed and several variations of the methods used are demonstrated with examples of application to the solution of three problems not solved before. These problems are of special interest in the field of underwater technology. Procedures for scaling data obtained with photoelastic models to predict the behavior of prototypes are illustrated. Difficulties involved in extending optical methods of complete analysis to three dimensional problems which have no planes of symmetry and to studies of compressional wave propagation in fluids are discussed. Author (TAB)

N70-10352# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
INITIAL FIELD STRENGTHS AND UTILIZATION FACTORS OF ROTATION-SYMMETRICAL ELECTRODE-ARRANGEMENTS IN A[R [ANFANGSFELDSTAERKEN UND AUSNUTZUNGSFAKTOREN ROTATIONSSYMMETRISCHER ELEKTRODENANORDNUNGEN IN LUFT]
Hans Steinbigler (Ph.D. Thesis) 1969 263 p refs In GERMAN
Avail: CFSTI

The investigations were focused on rotation-symmetrical electrode configurations having spherical surfaces at the point of discharge. This included spheres with circular-cylinder conductors, circular-cylinder rods with hemispherical points, and cones with rounded points. These electrodes were arranged either opposite grounded plates or grounded electrodes of identical geometry. The radii of curvature at the discharge point of the electrodes varied between 0.5 cm and 25.0 cm, the sparking distance between 2 cm and circa 2 m. In some of the experiments, the spark gaps were enclosed in a rotation-symmetrical grounded circular cylinder 1 m in diameter. To determine the initial field strength from the measured initial voltages for these electrodes (whose curvature radii are small when considering the long sparking distances), it was necessary to pay close attention to field changes caused by conductors or interfering electrodes nearby. For the theoretical calculations, a technique based on the method of electrical representation was developed which is suitable for numerical analyses on a digital computer. Transl. by K.W.

N70-10394# Idaho Univ., Moscow.
SPECTRAL ANALYSIS OF INFRASONIC SIGNALS
Thomas Harry Kuckertz (M.S. Thesis) Feb. 1969 114 p refs
Sponsored by NSF
Avail: Issuing Activity

Equations and computer programs were developed to calculate various spectral functions and the power density of an infrasonic signal. An infrasonic signal produced by a volcano eruption in the Galapagos islands on June 11, 1968, was analyzed by the computer programs. The analysis showed that the energy contained in the high frequencies of the signal arrived at the detection station first followed by the low frequencies followed finally by the frequencies at mid-band. Author

N70-10483# Stanford Univ., Calif. Microwave Lab.
OPTICAL PHYSICS AND NONLINEAR OPTICAL EFFECTS Final Report
A. E. Siegman and D. J. Kuizenga Jun. 1969 17 p refs
(Contract AF 49(638)-1525)
(AD-691887; ML-1758; AFOSR-69-1577-TR) Avail: CFSTI CSCL 20/6

Work was done in the area nonlinear optics, including a comprehensive experimental and analytical study of second-harmonic generation and other nonlinear optical effects in crystals. The nonlinearity in ADP was measured. Second-harmonic generation was also accomplished in the centro-symmetric crystal calcite, by applying a strong superimposed electric field. Work was done on the Nd YAG, and led to the following results: Using an electro-optic crystal inside the laser cavity, the laser was tuned over 130 GHz. The dynamics of a repetitively pulsed laser were studied. With an internal phase modulator the Nd YAG laser was phase-locked, and pulses as short as 38 ps were observed. The FM-laser mode of operation was also observed. The spectral and luminescent properties are rare-earth ions in semiconductors were studied, particularly GaAs doped with neodymium and manganese. This research was later diverted to the study of infrared absorption of free carriers in semiconductors, which led to an infrared converter tube. Author (TAB)

N70-10470# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SELECTED MATERIALS FOR USE IN MICROSOUND CIRCUITS AND COMPONENTS: THEIR ELASTIC, PIEZOELECTRIC, AND DIELECTRIC PARAMETERS
D. H. Chung 8 May 1969 15 p refs
(Contract AF 19(628)-5167)
(AD-692111; TN-1969-19; ESD-TR-69-109) Avail: CFSTI CSCL 20/1

Tables are set forth containing a critical compilation of the elastic, piezoelectric, and dielectric properties of crystals that are of potential interest in applications to microsound circuits and components. Elastic constants are provided for the total of 27 crystals, consisting of 10 semiconductors, 6 piezoelectrics, and 11 acoustic materials. Piezoelectric constants are given for 16 crystals.

and dielectric constants for 11 crystals of potential interest. All the property constants entered in these tables were taken from the literature. A brief description of each property is provided in the Appendix to assist users of these tables. Author (TAB)

N70-10512# Naval Ordnance Lab., White Oak, Md.
LINEAR THEORY OF BOTTOM REFLECTIONS
James R. Britt May 1969 147 p refs
(AD-691248; NOLTR-69-44) Avail: CFSTI CSCL 18/3

The report gives a detailed mathematical development of a linear, spherical wave theory for the reflection of underwater explosion shock waves from plane bottoms of either fluid or rigid materials. The Laplace transform method of L. Cagniard is used to obtain integral solutions for the pressure which can be evaluated numerically. The paper begins with linear equations of motion and proceeds in steps through the derivation of the wave equations and finally to solutions of the wave equations. Two methods of integrating the integral solution are discussed. First, the real part of the integral is separated from the imaginary part to allow integration using real arithmetic. Second, a method of integration using complex arithmetic is described. Author (TAB)

N70-10584# Washington Univ., Seattle. Dept. of Electrical Engineering.
SCATTERING OF ELECTRIC DIPOLE RADIATION BY A MOVING, DISPERSIVE DIELECTRIC HALF-SPACE
James Fred Holmes and Akira Ishimaru Apr. 1969 38 p refs
(Contract F19628-68-C-0126)
(AD-692174; SR-3; TR-133; AFCRL-69-0200) Avail: CFSTI CSCL 20/14

The problem of a point electric dipole moving over a dispersive dielectric half-space is studied. The dipole is located in the free space above the dielectric and is assumed to be time harmonic in its rest frame, oriented perpendicular to the interface and moving parallel to it. Previous work in this area has been mostly confined to the use of a plane wave as a source or a non-dispersive dielectric. Solutions for this problem are obtained using integral transform techniques. The integration is performed for the free space region by making an asymptotic expansion for one integration and then using the saddle point approximation for the remaining integration. The solution obtained in this manner for the vector potential is then used to generate the electric and magnetic fields in both the rest frame of the source and the rest frame of the dielectric. This yields the reflected radiation fields for the case of an arbitrary, dispersive dielectric and the lateral wave fields and surface wave fields for the case of a lossless plasma. The field patterns are distorted by the relative motion of the source and dielectric. In the rest frame of the source, all three waves exhibit the frequency of the source and in the rest frame of the dielectric, they all exhibit some form of Doppler shift (different from the primary wave). The criteria for existence of the lateral wave is not modified by the relative motion of the source and dielectric; but the criteria for existence of the surface waves is greatly modified by the relative motion. For velocities greater than some critical velocity, a new type of surface wave comes into existence. Author (TAB)

N70-10753# Deutsche Forschungs-und Versuchsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Inst. für Flugmechanik.
ON THE STATISTICAL ERROR OF FREQUENCY RESPONSE MEASUREMENTS IN THE CASE OF DIGITAL EVALUATION [UEBER DEN STATISTISCHEN FEHLER VON FREQUENZGANGMESSUNGEN BEI DIGITALER AUSWERTUNG]
Martin Marchand Apr. 1969 52 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-28) Avail: CFSTI

In determining the frequency response of a linear system by means of statistical methods, measured estimates of power spectra are used which are subject to statistical errors. The reason for these errors is the limited observation time and not measurable noise. Starting from the statistical properties of the estimates of power spectra, the statistical error of the frequency response measurement is investigated. How to obtain statements on the magnitude of error, for instance, in the form of confidence limits is described. The investigation is extended to the case where the system to be measured is included in a control system with known feedback. As an example, confidence limits for the measurement of the frequency response of the longitudinal motion of a helicopter are given. Author (ESRO)

N70-10802 Purdue Univ., Lafayette, Ind.
A TECHNIQUE FOR COMPUTING APPROXIMATE ELECTROMAGNETIC IMPULSE RESPONSE OF CONDUCTING BODIES
C. Leonard Bennett, Jr. (Ph.D. Thesis) 1968 159 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-7420

A numerical technique for the time domain solution of scattering by perfect conductors is described. The problem is broken into two cases. In the first case scattering by parallel cylindrical conductors with arbitrary cross sections is considered for arbitrary angles of incidence. The first step is to reduce the cylindrical scattering problem to a time-domain integro-differential equation for the magnetic field intensity on the scatterer contour. Next, the integro-differential equation is solved numerically for the magnetic field on the scatterer contour which, in turn, is used to compute the far field. The validity of this technique is demonstrated by using it to calculate the approximate impulse response of a circular cylinder for a normally incident wave. The results are in good agreement with those obtained from the classical frequency domain solution. To illustrate the versatility of the technique the approximate impulse response is also computed for a strip and a corner reflector. Dissert. Abstr.

N70-10804# North Carolina State Univ., Raleigh.
ON A PHYSICAL FOUNDATION FOR ELECTROMAGNETIC SYSTEM THEORY
Donald R. Rhodes 20 Jun. 1969 44 p refs
(Contract F19628-67-C-0255)
(AD-692120; SR-1; AFCRL-69-0273) Avail: CFSTI CSCL 20/3

The traditional basis for the theory of electromagnetic systems (e.g., circuits, microwave networks, antennas) is a collection of definitions describing their temporal and spectral properties. It is shown here that these properties are all derivable as a consequence of two physical assumptions, namely, the Maxwell-Lorentz theory of electromagnetism and the postulates of causality, linearity, time-invariance, and passivity. These two assumptions alone thus constitute an axiomatic physical foundation for electromagnetic system theory. Author (TAB)

N70-10844# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
THE EFFECTS OF LIGHT PROPAGATION IN SPHERICALLY SYMMETRIC METRICS
Jack Jaffe (Ph.D. Thesis) Sep. 1968 126 p refs
(CSR-T-68-6) Avail: CFSTI

An analysis is made of the possible unusual effects, as measured by an observer, introduced by considering the motion of light within the framework of general relativity. Effects from the emission and motion of light both within and exterior to spherically symmetric mass distributions are investigated. For the case of light emitted from a collapsing gas into space, it is found that the characteristics of an image received by a remote observer sometimes vary significantly from the classical situation. For the case of light

emitted within a mass distribution, it is found that, for certain ranges of the parameters of the model, there exist unusual motions and effects which are purely of a general relativistic nature. Author

N70-10978*# Cutler-Hammer, Inc., Melville, N.Y.
HIGH SENSITIVITY INFRARED 10.6 MICRON HETERODYNE Hg-Cd-Te RECEIVER DEVELOPMENT, PHASE ONE DESIGN REPORT
Sep. 1969 140 p refs
(Contract NAS5-11665)
(NASA-CR-106737; AIL-8783-1) Avail: CFSTI CSCL 20E

This report gives results of a study on the design of an infrared 10.6 micron quantum-noise-limited heterodyne receiver employing HgCdTe mixer elements, and operating near 100 K. Mixer parameters such as conversion gain, local oscillator power, DC bias power, resistance, frequency response and conductance ratio are investigated for operating temperature from 80 to 120 K. Operational receiver parameters such as Noise Equivalent Power, total power dissipation, error-sensing techniques and required infrared amplifier characteristic are also considered. Heterodyne operation in photoconductive HgCdTe is analyzed on several levels of complexity. Both n- and p-type photoconductive HgCdTe are considered. Engineering expressions for heterodyne operation in photovoltaic HgCdTe are presented. Supporting experimental results have been obtained. A measured NEP of 2.2 × 10 to the minus 19th power watt/Hz was obtained for a total power dissipation of less than 2 mw at a temperature of 77 K. The measured frequency response of the PV mixer was flat to 40 MHz. Author

N70-11171# Navy Underwater Sound Lab., New London, Conn.
THE ELECTRIC AND MAGNETIC FIELDS NEAR A BURIED LONG HORIZONTAL LINE SOURCE
Peter R. Bannister 4 Jun. 1969 27 p refs
(AD-692431; USL-991) Avail: CFSTI CSCL 20/14

Expressions for the electric and magnetic fields produced by a buried horizontal line source are derived for the special case of the quasi-static range in which the measurement distance is much less than an earth skin depth. It is shown that the resulting expressions are nearly identical to those produced by an elevated horizontal line source. Author (TAB)

N70-11190# New York Univ., N.Y. Dept. of Physics.
THEORY OF INTERACTION OF LIGHT WITH INSULATING CRYSTALS
Bernard Bendow and Joseph L. Birman 6 Sep. 1968 10 p refs Presented at the Intern. Conf. on Light Scattering Spectra of Solids, New York, 3 – 6 Sep. 1968 Sponsored in part by USAF
(Contract DA-ARO-(D)-31-124-G792)
(AD-692278; AROD-4054-24-P) Avail: CFSTI CSCL 20/12

The work develops a formal theory of the interaction of radiation in insulators at zero temperature, from which one obtains expressions for the transition probabilities for elementary processes such as Raman scattering and direct absorption. Three factors are given special attention in the formalism: (a) The electromagnetic field must be taken into account at all times, even when no external source of radiation is present; (b) Both absoption and scattering ought to be considered within a unified viewpoint; (c) Asymptotic scattering states should be defined unambiguously, and their precise relation to experiment specified. Author (TAB)

N70-11191# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
THE CONCEPT OF FIELD DISTORTION AND FIELDS IN SPARK GAPS (PRESSURE SPARK GAPS) [BEGRIFF DER FELDVERZERRUNG UND FELDER IN FUNKENSTRECKEN (DRUCKFUNKENSTRECKEN)]
G. Müller Nov. 1968 38 p refs In GERMAN; ENGLISH summary
(IPP-4/61) Avail: CFSTI

The distribution of static and dynamic electric fields of the pressurized switch unit for the Garching turbulence heating experiment was determined by measurements on carbon paper models. The results of these measurements are reported and compared with some approximate calculations. It is shown that spark gaps can be classified under two aspects. The meaning of 'field distortion' is examined and a more exact definition than hitherto available is presented. Author (ESRO)

N70-11214# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
RECOGNITION OF SELF-LUMINOUS OBJECTS WITH PENCIL-BEAM BRIGHTNESS IN A SCATTERING MEDIUM
A. Ya. Khayrullina 15 May 1969 10 p refs Transl. into ENGLISH from AN BSSR Dokl., v. 12, no. 6, 1968 p 503–505
(AD-692498; FTD-HT-23-1480-68) Avail: CFSTI CSCL 17/8

The authors examine the problem of relative sizes of self-luminous objects and their detectors, if the objects are to be recognized. Previous experiments have been conducted solely with the receiver size much greater than object size. The present authors have conducted experiments on model systems characterizing the probability of persistance of a light quantum and a coefficient of asymmetry of the scattering indicatrix of unit volume at different optical thicknesses. TAB

N70-11234*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
VISCOSITY MEASUREMENTS OF DILUTE SOLUTIONS OF HELIUM 3 IN SUPERFLUID HELIUM 4 BETWEEN 0.1 and 1.2 K
Rayjor W. H. Webeler and Gabriel Allen Washington Nov. 1969 14 p refs
(NASA-TN-D-5567; E-4847) Avail: CFSTI CSCL 07D

Viscosity measurements of three dilute solutions of He3 in superfluid He4 were made between 0.1 and 1.2 K for concentrations of 1.09, 1.57, and 4.67 atoms of He3 per 100 atoms of solution. A torsional crystal technique was employed. A slight change in slope became noticeable near the Fermi temperatures of each solution. The experimental results were in qualitative agreement but were considersbly below the theoretical predictions. In addition, for the 1.09 and 1.57 percent solutions, a sharp change in slope occurred near 0.3 K. A possible explanation for the discrepancy is suggested. Author

N70-11255# European Space Research Organization, Paris (France).
PROCEEDINGS OF THE SIXTH ESRO SUMMER SCHOOL, VOLUME 3: ENVIRONMENTS AND THEIR ROLE IN SPACECRAFT TECHNOLOGY: MAGNETIC ASPECTS
May 1969 46 p refs Conf. held at Noordwijk, Neth., Aug.–Sep. 1968
(ESRO-SP-42) Avail: CFSTI

CONTENTS:

1. SIMULATION OF THE MAGNETIC ENVIRONMENT IN THE LABORATORY O. G. Feil (ESRTC) p 5–21 refs (See N70-11256 01-11)

2. MAGNETIC TESTING OF SPACECRAFT O. G. Feil (ESRTC) and E. Wunderer (ESRTC) p 23–48 refs (See N70-11257 01-23)

N70-11267# European Space Research and Technology Center, Noordwijk (Netherlands).
MAGNETIC TESTING OF SPACECRAFT
O. G. Fail and E. Wunderer *In* ESRO Proc. of the 6th ESRO Summer School, Vol. 3: Environ. and their Role in Spacecraft Technol.: Magnetic Aspects May 1969 p 23–48 refs (See N70-11255 01-23)
Avail: CFSTI

The principal methods of measuring magnetic fields and magnetic moments are outlined and the types of magnetometer used in spacecraft testing are indicated. In addition, the practical application of the most common measuring method to the testing of boxes for a magnetically clean satellite is described. Author (ESRO)

N70-11288# American Inst. of Physics, New York. Information Div.
A PROGRAM FOR A NATIONAL INFORMATION SYSTEM FOR PHYSICS, 1970–1972
Aug. 1969 185 p refs Revised
(Grant NSF GN-710)
(PB-185388) Avail: CFSTI CSCL 05B

A program is presented for a National Information System for Physics based on a computerized AIP Information Service which is designed to augment the element of selectivity of the present information system for user interests. It is proposed that the system be developed in discrete stages, each adding to the capabilities of the system at the prior stage, in such a manner as to make use of the experience gained from pilot operation of one stage in completing the design of the subsequent one. Requirements for, as well as the capability of the AIP to implement the system starting in 1970, are documented. Author (USGRDR)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N70-10043*# Houston Univ., Tex. Dept. of Physics.
SUPPORT-STUDIES FOR THE CORONAGRAPH CONTAMINATION EXPERIMENT, 1 SEPTEMBER 1968–31 AUGUST 1969
Natalie S. Kovar 31 Aug. 1969 25 p
(Contract NAS9-8869)
(NASA-CR-101984) Avail: CFSTI CSCL 20H

The work accomplished during the year is reported. The major topics are: (1) calculation of the Mie scattering functions for a mixture of particles of different sizes, (2) revision of the computer program for the calculation of Mie scattering, (3) calculation of the Mie scattering functions for uniform size particles, and (4) calculation of Mie scattering function for ultraviolet incident light. F.O.S.

N70-10058# Oak Ridge National Lab., Tenn. Isotopes Information Center.
ENRICHMENT OF NATURAL AND RADIOACTIVE KRYPTON ISOTOPES IN A THERMAL DIFFUSION COLUMN
J. Meinrenkin [1969] 12 p refs Transl. into ENGLISH from Z. Naturforsch. (Tubingen), no. 22a, 1967 p 1261–1266
(ORNL-tr-1870) Avail: CFSTI

The effects of pressures up to 760 torr, temperatures between 1050 and 2050 K, and tube diameters between 7.1 and 12.4 mm on the separation of a mixture of natural krypton isotopes in a separation tube were measured. A diameter of 8 mm was found to be most suitable. In an arrangement of 12 tubes with a total length of 40 m the behavior of krypton isotopes, especially the enrichment of the middle isotopes, was studied. NSA

N70-10060# Brookhaven National Lab., Upton, N.Y. Rochester
POSITIVE KAON-PROTON AND NEGATIVE KAON-PROTON BACKWARD SCATTERING IN THE ENERGY REGION FROM 1.0 TO 2.5 GeV/c
A. S. Carroll, J. Fischer, A. Lundby, F. Lobkowicz, A. C. Melissinos et al 26 Aug. 1968 34 p Held at the 14th Intern. Conf. on High Energy Phys., Vienna, Austria Prepared in part by Rochester
(Contract AT(30-1)-875)
(UR-875-254; Conf-680809-33) Avail: CFSTI

The wire spark chamber system is described, and the angular distributions for K(+)p and K(−)p backward elastic scattering are presented. Also, the possibility of resonances is investigated. NSA

N70-10062# Hawaii Univ., Honolulu. Physics and Astronomy Dept.
THE HIGH ENERGY PHYSICS GROUP Annual Progress Report
30 Sep. 1968 67 p
(Contract AT(04-3)-511)
(UH-511-35) Avail: CFSTI

A brief summary of the experimental and theoretical programs at Hawaii University are presented. Spark chamber experiments bubble chamber experiments, research staff, publications and talks, hardware and software support, and computer development are discussed. Topical conferences in particle physics, consultants and theory visitors, and theoretical work are also discussed. NSA

N70-10065# Brookhaven National Lab, Upton, N.Y. Information Div.
CROSS SECTIONS FOR FISSION OF BI 209, U 235, U 238, NP 237, AND PU 239 BY 1 TO 9-GeV PROTONS
E. S. Matusevich et al 1968 10 p refs Transl. into ENGLISH from Yadern. Fiz. (Moscow), v. 7, no. 6, 1968 p 1187–1189
(BNL-TR-235) Avail: CFSTI

Cross sections of fission by protons with energies 1–9 GeV are obtained for a number of elements. The measurements are fulfilled by means of the inner proton beam at the proton synchrotron. The number of fission events was determined from the traces of fragments in glass. The number of protons was determined from the reaction Al-27(p,3pn)Na-24. The obtained results are compared with previous data. Author (NSA)

N70-10066# Scientific Translation Service, Ann Arbor, Mich.
CALCULATION OF THE ENERGY DISTRIBUTION OF HIGH ENERGY NEUTRONS IN A SHIELD [RASCHET ENERGETICHESKOGO RASPREDELENIYA NEITRONOV VYSOKIKH ENERGII V ZASHCHITE]
B. S. Sychev [1968] 28 p refs Transl. into ENGLISH from report JINR-p16-3593 (Dubna, USSR), 1967 p 1–27 Submitted for Publ. Prepared for ORNL
(ORNL-TR-1191) Avail: CFSTI

An approximate method of calculation is given for the energy distribution of E > 20-MeV neutrons in a semi-infinite shielding, the surface of which is exposed to the neutrons with the initial energy of some hundreds of MeV. Author (NSA)

N70-10080# Joint Inst. For Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
CHARGE AND ISOTOPE DISTRIBUTIONS OF THE EXCITED NUCLEUS FRAGMENTS IN THE HIGH ION REACTIONS
S. A. Karamyan, Yu. Ts. Oganesyan, Yu. E.Penionzhkevich, and B.I. Pustylnik 1968 35 p refs In RUSSIAN
(JINR-P7-4024) Avail: CFSTI

Charge and isotope distributions of fragments were measured while fissioning U-238 with C-12, Ne-20, and Ar-40 ions. It was found that the charge dispersion of fission fragments (sigma sub z) squared at the given mass increases strongly with the increasing parameters Z/A of the fissioning excited nucleus at Z squared A > 38. It was also found that the fragment charge fluctuation decreases with the increasing parameter of separation (A sub 1/A sub 2). It is shown that the value sigma z squared is a weak function of the excitation energy of the initial nucleus. The experimental results are in disagreement with the predictions of the statistical theory of nuclear fission. Author (NSA)

N70-10086# Argonne National Lab., Ill.
ON THE APPLICATION OF SEMICONDUCTOR DETECTORS IN X-RAY FLUORESCENCE ANALYSIS [ISPOLZOVANIE POLUPROVODNIKOVYKH DETEKTOROV DLYA EMISSIONNOGO RENTGENOVSKOGO ANALIZA]
V. Pshiborski et al Jun. 1968 13 p refs Transl. into ENGLISH of Polish report INR-820/11/PS
(ANL-Trans-631; INR-820/11/PS) Avail: CFSTI

Some preliminary results on the possible application of semiconductor detectors for the qualitative Xray fluorescence analysis are presented. Characteristic Xray spectra of Mo, Ag, In, Sn, Ce, Au, Pt, Ta, W excited by gamma rays from Americum 241 and Cobalt 57 sources are presented. Author (NSA)

N70-10097 Yale Univ., New Haven, Conn.
APPLICATIONS OF THE GROUP R SUB 4 TO ATOMIC STRUCTURE THEORY
Joseph Seth Alper (Ph.D. Thesis) 1968 87 p refs
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-8308

A brief account is given of the theory of Lie groups and their use in atomic structure theory. One example of such a group, the rotation group in four dimensions R sub 4, is applied to the study of the 2s(m)2p(n) configurations of atoms. The various states of each configuration are classified by means of irreducible representations of R sub 4. By expressing the Coulomb operator in terms of tensors transforming according to irreducible representations of R sub 4., Coulomb and exchange integrals are evaluated. The method is then extended to 3s(m)3p(n)3d(r) configurations. The group R sub 4 is then applied to the study of energy level separations and correlation energies in first row atoms. The method is then extended to the treatment of the nondynamical correlations in second row atoms. Dissert Abstr.

N70-10112 St. Louis Univ., Mo.
DYNAMIC NUCLEAR POLARIZATION IN SYNTHETIC RUBY
Richard Kahr Jeck, Jr. (Ph.D. Thesis) 1968 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-353

Dynamic polarization of Al-27 nuclear spins by means of the solid effect of magnetic resonance was studied in single crystals of synthetic ruby, having Cr(+++) concentrations in the range 0.028% to 0.145% by weight. Experiments were done at temperatures of 77 deg K and 300 deg K and included measurements of the Al-27 NMR enhancement as a function of the microwave power level applied at various positions along the Cr(+++) ESR envelopes. At 300 deg K a maximum enhancement of 6 was obtained in the pink samples. The magnitude of the NMR enhancement as a function of the microwave power level, sample temperature, and Cr(+++) concentration is generally consistent with Jaffries' shell of influence model of nuclear dynamic polarization and relaxation. An interesting effect involving the enhancement of the dipolar structure on the Al-27 NMR lines was observed in ruby. When microwave power is applied at a position near the center of the Cr(+++) ESR envelopes, parts of the component dipolar structure appearing on the NMR lines are positively enhanced while other portions of the structure are negatively enhanced. Dissert. Abstr.

N70-10164# Du Pont de Nemours (E.I.) and Co., Aiken, S.C. Savannah River Lab.
PLUTONIUM 239 IN NATURE
V. V. Cherdyntsev et al [1969] 10 p refs Transl. into ENGLISH from Geokhim. (Moscow), no. 4, 1968 p 395–401
(AEC-tr-6988) Avail: CFSTI

The content of Pu-239, the product of decay of the transuranium isotope (probably Cm-247) with 4.4 to 4.6 MeV energy, was investigated in various natural formations. In a number of cases preparations of the transuranium isotope were investigated. The best results were obtained by sublimation from nitrate solutions. By its chemical properties the isotope must closely approaches osmium. In ferruginous–manganese deposits of recent volcanism the content of plutonium reaches 7.4 x 10 to the minus 10th power %, in neovolcanic rocks 3.9 x 10 to the minus 11th power %, in manganese concretions of the ocean 6 x 10 to the minus 11th power %, and in meteorites 3.5 x 10 to the minus 12th power % when the Pu/U ratios are 1.7 x 10 to the minus 5th power, 1.8 x 10 to the minus 6th power, 5.5 x 10 to the minus 8th power, 1.25 x 10 to the minus 6th power, respectively. The geochemical features of plutonium behavior are considered. Author (NSA)

N70-10184# Ghent Univ. (Belgium).
THE INDUSTRIALISATION OF 14 MeV NEUTRON ACTIVATION ANALYSIS FOR OXYGEN IN STEEL
R. Gijbels, J. Hoste, and A. Speecke Brussels EURATOM 1969 28 p refs
(Contract EURATOM-098-66-10 IRAB)
(EUR-4297-e) Avail: CFSTI

A relative method for the determination of oxygen in steel via the 016(n,p)N16 reaction by means of 14-MeV neutrons is described. A standard is irradiated immediately behind the sample and the induced activities are counted simultaneously with two separate but identical detector systems. The standard mixture (ca. 5 g of graphite plus iron oxide containing 80 mg of oxygen per g) is compressed into a steel capsule of the same external dimensions as the samples (25 mm diameter, 9 mm thick). Dimensional tolerances, choice and purity control of the oxygen compound and preparation of the standard mixture are discussed. Fast neutron shielding, absorption of fast neutrons, self-absorption of the N-16 gamma-rays and the average neutron flux in sample and standards are considered and a total correction factor is established. Flux inhomogeneities and differences in counting geometry and discriminator setting can be determined by irradiation and counting of two identical standards. Author

N70-10220# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
SLABBO: A DISCRETE ORDINATE NEUTRON TRANSPORT CODE IN PLANE GEOMETRY WITH ANISTROPIC SCATTERING
B. E. Clancy Jul. 1969 8 p refs
(AAEC/TM-505) Avail: CFSTI

A description is given of the SLABBO code which computes

solutions of the inhomogeneous multigroup neutron transport equation for plane slabs with free boundary conditions. The neutron source at one boundary can be chosen arbitrarily in both energy and angle and the code converges on the angular fluxes transmitted through the slab. Anisotropic scattering is permitted and an adjoint option is included. Author

N70-10227# Hungarian Academy of Sciences, Budapest.
A REMARK ON THE OBSERVATION OF NEUTRAL S MESON
T. Gemesy and G. Suranyi 5 May 1969 6 p refs
(KFKI-13/1969) Avail: AEC Depository Libraries

In order to use the interaction positive pion + neutron yields proton + neutral X to search for the neutral S meson one must rule out the possibility of the existence of a background channel which could give a bump as a kinematic effect in the neutral pion effective mass distribution at about 720 MeV. The channel in question having probably higher cross section than the neutral S at this energy is positive pion + neutron yields positive N^* + neutral pion yields proton + 2 neutral pions. The effective mass distribution in this channel is calculated using the Stodolsky–Sakurai model. It is concluded that the positive pion + neutron yields positive N^* + neutral pion channel does not affect the observation of the neutral S meson resonance. NSA

N70-10263# European Atomic Energy Community, Ispra (Italy). Reactor Physics Dept.
INELASTIC NEUTRON SCATTERING AND LATTICE DYNAMICS OF METALS IN QUASI-ION APPROXIMATION, PART 2
K. Krebs and K. Hoelzl 1969 139 p refs
(EUR-3621-e-Pt-2) Avail: CFSTI

On the basis of the pseudo-ion model the following lattice dynamic quantities have been calculated; formfactors, effective potentials, phonon densities of state, dynamical structure factors, and effective Debye temperatures. Results are presented for 10 cubic metals. Listings are given of the pertinent FORTRAN 4 programs. For Part 1 see N68-10058. Author

N70-10268# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
NUCLEON AND NUCLEON GROUP TRANSFER REACTIONS INDUCED IN THE BOMBARDMENT OF Au 197 AND Th 232 BY C 12, N 14, N 15 PROJECTILES
V. V. Volkov, G. F. Grinev, G. N. Zorin, and L. P. Chelnokov [1968] 31 p refs
(JINR-E7-4071) Avail: AEC Depository Libraries

Gold-197 and Th-232 targets were bombarded by C-12, N-14, N-15, projectiles at energies of 82, 110, and 98.5 MeV, respectively. Differential cross sections and energy spectra were measured for the transfer of one proton, one neutron, a deuteron, He-3, and He-4. The angular distributions of all transfer reactions have a peak at the angle, corresponding to the Rutherford scattering of two nuclei by grazing collision. The cross section of the few-nucleon transfer differs only slightly from that of the single-nucleon transfer. The energy spectra of the He-3 transfer turned out narrower than those of the proton transfer. These results indicate the possibility of the cluster level excitation by the few-nucleon transfer. The He-4 pick-up cross section was smaller than some microbrans; it is possible that the alpha particle is picked up by the unbound levels of the projectiles. Author (NSA)

N70-10277# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
THE MEASUREMENT AND THEORETICAL ANALYSIS OF DIFFERENTIAL NEUTRON ENERGY SPECTRA FOR SLAB LATTICES OF MULTIPLYING MEDIA
A. W. Dalton Apr. 1969 34 p refs
(AAEC/TM-497) Avail: CFSTI

Chopper measurements were made of the neutron energy spectrum in the beryllia moderator of slab lattices containing fuel enriched in either U-235 or U-233 for wide ranges of fuel to moderator ratios. The energy range extended from thermal up to about 350 eV. Theoretical predictions of the spectra for the same slab lattices were made using computer programmed transport theory calculations. Excellent agreement was obtained with the measured spectra. Author

N70-10286# Argonne National Lab., Ill.
FILM-TYPE SCINTILLATION DETECTOR FOR MEASUREMENT OF THE TOTAL NUMBER OF CAPTURES IN THE RESONANCES OF THE (n, gamma) REACTION [STSINTILLYATSIONNYI DETEKTOR NA PLENKAKH DLYA REZONANSAKH REAKTSII (n, gamma)]
L. S. Danelyan Jul. 1968 10 p refs Transl. into ENGLISH of Akad. Nauk SSSR report IAE-1349
(ANL-Trans-642; IAE-1349) Avail: CFSTI

With the aid of the film-type scintillation detector, which displays a constant recording effectiveness with respect to the (n,gamma) capture reaction from resonance to resonance, it is shown that the relative magnitudes of the total number of captures in resonances, required to calibrate the intensities of partial gamma-transitions from levels of the nucleus Gd-155 + n, are determined by means of the NaI(Tl) crystal with a satisfactory accuracy (no worse than 5%). Author (NSA)

N70-10330*# Lowell Technological Inst. Research Foundation, Mass.
FEASIBILITY STUDY OF VACUUM GAUGING USING ELECTRON-INDUCED SOFT X-RAYS
Kirtland H. Olson, Joseph L. Wiza, and Andrew J. Borsa Jul. 1969 83 p refs
(Contract NAS12-2127)
(NASA-CR-86261; LTIRF-300/TA) Avail: CFSTI CSCL 20H

A theoretical and experimental program was launched to establish the feasibility of density measurements at low pressures by means of a relatively novel yet straightforward approach. The technique consists of observing the soft X-ray radiation produced when gases are bombarded by monoenergetic electrons in the 5 to 20 kev energy range. Both continuum X-ray production (thin target bremsstrahlung) and characteristic K alpha emission were considered. The continuum X-ray yield measures a composition averaged density; the intensity of characteristic radiation (e.g. the carbon K alpha line at 44A) reveals elemental densities. In the analysis of the bremsstrahlung production process, the Sommerfeld Theory was used as extended for computer calculation. This nonrelativistic theory neglects orbital electron screening of the nuclear charge. The feasibility of using characteristic X-rays to determine gas composition was explored. Author

N70-10355 European Organization for Nuclear Research, Geneva (Switzerland).
EXPERIMENTAL STUDY OF THE PRODUCTION OF CHARGED PIONS BY 600-MeV PROTON NUCLEI COLLISIONS [ETUDE EXPERIMENTALE DE LA PRODUCTION DE PIONS CHARGES DAN LES COLLISIONS PROTON-NOYAU A 600 MeV]

W. Hirt (Ecole Polytech. Federale), E. Heer (Univ. de Geneve), M. Martin (Univ. de Geneve), E. G. Michaelis, C. Serre (Univ. de Grenoble) et al 5 Sep. 1969 95 p refs In FRENCH; ENGLISH summary
(CERN-69-24) Copyright. Avail: Issuing Activity

The production of charged pions by 600 MeV protons on nuclei has been studied. A detailed description of the experimental procedure is given. The measured differential production cross sections are given for Be, C, Al, Cu, Ag, Pb, CH_2 and CD_2 at pion energies between 50 and 350 MeV and production angles of 0.8 and 21.5 deg. A comparison with other results, and a theoretical investigation of the data were made. Author

N70-10380 Michigan Univ., Ann Arbor.
DIRECT SPIN-CRYSTAL FIELD INTERACTION IN SOLIDS
Clyde Arthur Morrison (Ph.D. Thesis) 1968 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-2361

The purpose is to investigate the consequences of the first order relativistic corrections to the Schroedinger equation for an ion in a nonspherically symmetric potential. The first order correction term is derived from the Dirac equation in much the same manner as the usual spin-orbit interaction. Dissert. Abstr.

N70-10388 Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany). Sektor Kernchemie
ANNUAL RESEARCH REPORT, 1968
Oct. 1969 25 p refs
(HMI-B-84) Copyright. Avail: Issuing Activity

The sorption of alkali metal ions stopping before reaching the expected capacity in cynoferrates was studied. It is explained by the assumption that the exchange of heavy metal ions for alkali metal ions is stopped by blockage of diffusion paths in the crystal lattice. Other topics included in the report are: separation of fission products by countercurrent electrolysis, chemical aspects of reactor safety, phenomena transport and disorder in solids, effects of nuclear processes in solids, and trace elements in calcite and dolomite. F.O.S.

N70-10390*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
CALCULATED TOTAL ELASTIC SCATTERING CROSS SECTIONS FOR H(1S) PLUS H(1S) AT COLLISION ENERGIES BELOW 1eV
Michael E. Gersh and Richard B. Bernstein 29 Aug. 1969 13 p refs
(Grants NGL-50-002-001; NSF-GP-7409)
(NASA-CR-106616; WIS-TCI-357) Avail: CFSTI CSCL 20H

The use of the interatomic potential functions for the calculation of scattering cross sections is studied for developing a reliable prediction of atomic beam scattering. The total elastic cross sections were calculated over a range of collision energies from 2.5 x 0.00001 to 1.0 eV, using the Fox and Gal formula appropriate for the scattering of unpolarized H(1S) beams. Results are graphed and tabulated. F.O.S.

N70-10480# Notre Dame Univ., Ind. Dept. of Physics.
NUCLEAR STRUCTURE RESEARCH Annual Report, 1 Jan.–31 Dec. 1968
Jul. 1969 39 p refs
(Contract N00014-67-A-0242; Grant NSF GP-8647)
(AD-692138) Avail: CFSTI CSCL 20/7

The document is the annual progress report for 1968 on nuclear structure research at the University of Notre Dame Physics Department. It discusses the installation and testing of the modified model FN Tandem accelerator and construction, improvement, and maintenance of the accelerator auxiliary equipment. Reports are given on the experiments being conducted. TAB

N70-10497# Stanford Univ., Calif. Dept. of Physics.
NUCLEAR STRUCTURE INVESTIGATIONS WITH AN FN TANDEM ACCELERATOR Progress Report, 1 Feb. 1968–28 Feb. 1969
Stanley S. Hanna and Walter E. Meyerhof 29 Aug. 1969 145 p refs
(Grant NSF GP-8163)
Avail: Issuing Activity

The continuing study of high-isospin states in light nuclei showed that in certain cases these states can be produced by double isospin forbidden compound nucleus reactions. The completion of a neutron time of flight system allowed the use of (He-3,n) reactions in many investigations, mostly involving the formation of high-isospin states. The gamma and particle decay studies of the high-isospin states are beginning to be sufficiently complete for the first appearance of systematic features. Studies of the giant resonance were extended. Similarities in the angular distribution of the capture gamma rays are quite prevalent. In Sr-88 and Zr-90 the split-up of the giant resonance into isospin components has been established. Capture and other reactions were used to clarify the level structure of He-4 and neighboring light nuclei. Lifetimes of several nuclear states were determined. Inelastic scattering and transfer reactions were used to elucidate details of certain nuclear levels. Author

N70-10508*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
COORDINATES WHICH DIAGONALIZE THE KINETIC ENERGY OF RELATIVE MOTION
Joseph O. Hirschfelder 26 Mar. 1969 26 p refs
(Grant NGL-50-002-001)
(NASA-CR-106615; WIS-TCI-342) Avail: CFSTI CSCL 20H

The most general sets of coordinates which diagonalize the relative kinetic energy of an N particle system are derived. These include reaction coordinates which are symmetric with respect to both the reactants and products. The angle of skewing of an idealized potential energy surface determines whether a molecular collision is adiabatic or leads to an exchange reaction. The shape of the potential energy surface leads to vibrationally excited diatomic molecules as products in hydrogen-halogen reactions. Author

N70-10539 Purdue Univ., Lafayette, Ind.
A MASS SPECTROMETRIC STUDY OF SINGLE CRYSTAL VAPORIZATION AND MOLECULAR EFFUSION
Thomas Edward Joyce (Ph.D. Thesis) 1968 207 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 69-7464

A determination of the effect of orifice geometry on the flux of molecules emitted along the axis of a right circular cylindrical orifice of a Knudsen cell was made. A measurement of the partial pressures of the species in equilibrium with KCl was carried out and the effect of the crystallographic orientation of the vaporizing surface of KCl single crystals on the vaporization process was assessed. It was found that orifice geometry has no clear effect on the flux of molecules emitted from the Knudsen orifice along the 0 deg trajectory and further, no demonstrable effect of orifice geometry on the composition of the vapor species was observed. The partial pressure of the monomer and dimer in equilibrium with solid KCl was examined using Knudsen cells whose orifices had a length-to-radius ratio of 0.1. The pressures were measured over the range 530 deg-810 C. The heats of vaporization at 298 K were found to be 51.8 kcal/mole and 59.8 kcal/mole for the monomer and dimer respectively by the second law method and 52.8 kcal/mole and 69.5 kcal/mole by the third law method. Dissert. Abstr.

N70-10580*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SEARCH FOR LINE STRUCTURE IN THE X-RAY SPECTRUM OF SCO X-1

S. S. Holt, E. A. Boldt, and P. J. Serlemitsos Oct. 1969 13 p refs Submitted for publication

(NASA-TM-X-63725; X-611-69-456) Avail: CFSTI CSCL 20H

Recently obtained data from a rocket-borne exposure to X-rays from Sco X-1 are shown to yield a positive indication of iron line emission at 3.25 sigma which is at a level approximately an order of magnitude below previously published upper limits. Such emission is consistent with a bremsstrahlung source of universal abundance, but the overall continuum shape indicates significant departures from an isothermal source. Author

N70-10581*# National Aeronatuics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ELASTIC SCATTERING OF ZERO ENERGY POSITRONS BY HELIUM ATOMS

S. K. Houston and B. L. Moiseiwitsch (Queen's Univ. of Belfast) Oct. 1969 23 p refs Submitted for publication

(NASA-TM-X-63728; X-640-69-469) Avail: CFSTI CSCL 20H

Kohn's variational method is used to calculate the scattering length for collisons between zero energy positrons and helium atoms in their ground state. The trial function used depends on several exponential parameters and up to twenty linear parameters and includes explicitly correlation between the positron and the electrons of the atom. The trial function also depends on the ground state wave function psi sub o of the helium atom and we have attempted calculations using six different approximations to psi sub o. The calculations all seem to diverge except when a Hartree Fork approximation to psi sub o is used. Also calculated was the effective electron Z sub eff which gives the rate of annihilation of positrons in helium. Author

N70-10590*# Oak Ridge National Lab., Tenn. Neutron Physics Div.

TABULATED CROSS SECTIONS FOR HYDROGEN AND HELIUM PARTICLES PRODUCED BY 61-MeV PROTONS ON Fe56

F. E. Bertrand and R. W. Peelle Nov. 1969 48 p refs

(NASA Order L-12186; NASA Order R-104(1); Contract W-7405-eng-26)

(NASA-CR-106654; ORNL-4456) Avail: CFSTI CSCL 20H

Tabulated differential cross sections are presented for the production of proton, deuteron, triton, helium-3, and alpha particles from Fe-56 bombarded by approximately 61-MeV protons. Continuum cross sections are listed at 10 angles from 20 deg through 160 deg. Angular distributions are given for excitation of states at 0-, 0.85-, 2.66-, 3.11-, 4.55-, 5.26-, and 6.79-MeV in iron-56; 0-, 0.41-, 0.93-, 1.92-, 2.99-, 4.97-, and 7.86-MeV in iron-55; and the ground state in iron-54. Author

N70-10594# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.

NUCLEAR INTERACTIONS IN THE ATMOSPHERE AND HIGH ALTITUDE EMULSION CHAMBERS

Aug. 1969 75 p refs

(RIFP-92) Avail: CFSTI

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1. OBSERVATION OF EXTREMELY HIGH ENERGY NUCLEAR INTERACTION BY MEANS OF HUGE EMULSION CHAMBER AT MT. CHACALTAYA M. Akashi, Z. Watanabe (Hirosaki Univ., Japan), K. Nishikawa, Y. Oyama (Konan Univ., Japan) A. Nishio et al p 1–33 refs (See N70-10595 01-24)

2. PROPAGATION OF COSMIC RAYS IN THE ATMOSPHERE AND MODEL OF MULTIPLE MESON PRODUCTION Y. Fujimoto, S. Hasegawa, K. Kasahara, A. Ohsawa, and T. Shibata (Waseda Univ., Japan) p 34–44 refs (See N70-10596 01-24)

3. PROPAGATION OF COSMIC RAYS IN THE ATMOSPHERE AND MODELS OF MULTIPLE MESON PRODUCTION (EXTENSIVE MONTE CARLO CALCULATION) Y. Fujimoto, S. Hasegawa, K. Kasahara, A. Ohsawa, T. Shibata (Waseda Univ., Japan) et al p 45–61 refs (See N70-10597 01-24)

4. MULTIPLE MESON PRODUCTION IN COSMIC RAY ENERGIES AND ACCELERATOR ENERGIES N. Yajima (Kyoto Univ., Japan), Y. Fujimoto, S. Hasegawa, H. Nanjo, K. Tanaka et al p 62–73 refs (See N70-10598 01-24)

N70-10595# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.

OBSERVATION OF EXTREMELY HIGH ENERGY NUCLEAR INTERACTION BY MEANS OF HUGE EMULSION CHAMBER AT AMOUNT CHACALTAYA

A. Nishio, M. Akashi (Hirosaki Univ., Japan), Z. Watanabe (Hirosaki Univ., Japan), K. Nishikawa (Konan Univ., Japan), and Y. Oyama et al (Konan Univ., Japan) *In its* Nucl. Interactions in the Atmosphere and High Altitude Emulsion Chambers Aug. 1969 p 1–33 refs (See N70-10594 01-24)

Avail: CFSTI

The emulsion chamber experiment revealed existence of the H-quantum. The results show production of a fireball with constant rest energy of 2-3 GeV. Combining these results with those of balloon experiments with emulsion chamber and of an analysis on nuclear interactions by artificial beam of CERN accelerator, it is found that production of the H-quantum is the main process responsible for multiple production of mesons over a wide range of interaction energies from 10 GeV up to around 30,000 GeV. In the high altitude emulsion chamber experiments, analyses are made on nuclear interactions generated in the layer of pitch, called C-jets. Measurements are made on energy and emission angle of gamma rays produced in C-jets with use of cascade showers detected by the lower emulsion chamber. Constancy of fireball mass suggests that mesons and baryons are composite systems of the fundamental particles. Observations were also made on a huge air shower in its early stage of development in order to study gamma ray families. A preliminary analysis shows that the main core is originated from a nuclear interaction with the total radiative energy of 6000 GeV. Author

N70-10596# Waseda Univ., Tokyo (Japan). Science and Engineering Lab.

PROPAGATION OF COSMIC RAYS IN THE ATMOSPHERE AND MODEL OF MULTIPLE MESON PRODUCTION

Y. Fujimoto, S. Hasegawa, K. Kasahara, A. Ohsawa, and T. Shibata *In* Kyoto Univ. Nucl. Interactions in the Atmosphere and High Altitude Emulsion Chambers Aug. 1969 p 34–44 refs (See N70-10594 01-24)

Avail: CFSTI

Results of the jet shower study with emulsion chamber confirm that production of the H-quantum is the essential of multiple production of mesons at least up to a range of interaction energy = 20 TeV. The H-quantum is an energy quantum of two or three times that of the nucleon rest energy and is supposed to transform into a number of mesons within a short time after its production. Calculations were made on production and diffusion of various cosmic ray components (nuclear active, electromagnetic and mu-mesonic) through the atmosphere on a basis of the H-quantum theory of multiple production. The calculation is made in such a way as to be applicable not only to the H-quantum case but also to other cases of the multiple production. Author

N70-10597# Waseda Univ. Tokyo (Japan). Science and Engineering Lab.

PROPAGATION OF COSMIC RAYS IN THE ATMOSPHERE AND MODELS OF MULTIPLE MESON PRODUCTION (EXTENSIVE MONTE CARLO CALCULATION)

Y. Fujimoto, S. Hasegawa, K. Kasahara, A. Ohsawa, T. Shibata et al *In* Kyoto Univ. Nucl. Interactions in the Atmosphere and High Altitude Emulsion Chambers Aug. 1969 p 45–61 refs (See N70-10594 01-24)

Avail: CFSTI

The three dimensional complete simulation is carried out on the propagation of very high energy cosmic rays in the atmosphere. The Monte Carlo simulation provides important clues to the analysis of experimental data of the emulsion chambers and direction for the future planning. The phenomena simulated are the nuclear active and electromagnetic cascade processes. The elementary processes in these cascades are multiple meson productions, decyas of mesons, pair creations by gamma rays, bremsstrahlung by electrons, and multiple Coulomb scattering of electrons. All primary particles are assumed to be protons and to rush into the atmosphere vertically. Author

N70-10598# Waseda Univ., Tokyo (Japan). Science and Engineering Lab.

MULTIPLE MESON PRODUCTION IN COSMIC RAY ENERGIES AND ACCELERATOR ENERGIES

Y. Fujimoto, S. Hasegawa, H. Nanjo, K. Tanaka, N. Yajima (Kyoto Univ., Japan) et al *In* Kyoto Univ. Nucl. Interactions in the Atmosphere and High Altitude Emulsion Chambers Aug. 1969 p 62–73 refs (See N70-10594 01-24)

Avail: CFSTI

Angular distribution of secondary particles in emulsion stacks exposed to 22.4 and 24.0 GeV/C proton beam were studied. In these stacks 1656 jets were found by the track following scanning. The criteria used to select the collision of a proton with a free proton or a quasi-free nucleon in the emulsion nucleus are the number of heavy tracks, the number of shower particles, and the inelasticity in the mirror system. It was found that there exist fireballs of mass about 2.2 GeV moving with Lorentz factor of 1.05 to 1.10. The factor obtained is somewhat smaller than that of the results of emulsion stacks. This means that the fireball is not produced yet freely by incident pions of 10 GeV/C. Angular distributions are shown of secondary pions from nuclear interactions of pions and of protons with incident energy around 20 GeV. It is seen that the distributions are essentially the same and they show the moving fireball with Lorentz factor between 1.2 and 1.4. -It is concluded that the accelerator region is just above the threshold of the H-quantum production. Author

N70-10606# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.

MUON CAPTURE IN LEAD

Donald Sashin and Irving Nadelhaft (Ph.D. Thesis) Oct. 1968 92 p refs

(Contract AT(30-1)-882)

(CAR-882-23) Avail: CFSTI

The dissappearance rate, decay date and decay electron energy spectrum were measured for negative muons stopping in a thin lead sheet sandwiched between two optical spark chambers. Acrabon reference target was used to eliminate the necessity of knowing the precise value of the detection efficiency of the apparatus, and the muon concentration of the beam of particles from the cyclotron. The decay electron energy spectrum was also found for muons stopping in the spark chambers enabled the elimination of most of the background of muons stopping in material other than the target. The decay electron energy was measured in a large sodium iodide crystal. The decay and disappearance rates for negative muons in lead were found to be .46 + or - .03 (10-6/sec)and 13.1 + or - .9 (10-6/sec) respectively. Author (NSA)

N70-10623# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

SURFACE RAINBOWS: A SIMILITUDE BETWEEN CLASSICAL AND DIFFRACTIVE SCATTERING OF ATOMS FROM CRYSTALLINE SURFACES

J. Doyle Mc Clure Aug. 1969 27 p refs Submitted for publication

(D1-82-0885) Avail: CFSTI

A preliminary account is given of sharp rays and related intensity structure revealed by high resolution classical calculations of atomic scattering from an ordered monolayer. Factors related to use of structural features of the intensity maxima for investigation of atom-surface interaction fields are discussed. Author

N70-10626*# Pittsburgh Univ., Pa. Space Research Coordination Center.

EXCITATION OF ATOMIC HYDROGEN TO THE METASTABLE 2 2S1/2 STATE BY ELECTRON IMPACT

W. E. Kauppila, W. R. Ott, and W. L. Fite 18 Sep. 1969 33 p refs Sponsored in part by NSF

(Grant NGL-39-011-002)

(NASA-CR-106853; SRCC-102) Avail: CFSTI CSCL 20H

The cross section for excitation of atomic hydrogen to the 2 2S1/2 state by electron impact has been remeasured in a modulated crossed beam experiment in the energy range extending from threshold to 1000 eV. Absolute values for the 2S cross section were obtained by measuring the ratio of the 2S to 2P cross sections and using previous measurements of the 2P cross section, which were normalized to the Born approximation at high energies. The atoms excited to the 2P and 2S states were detected by observing the Lyman alpha photons produced by radiative decay and by quenching in an electrostatic field, respectively. In order to determine the total cross section, it was necessary to consider the polarization of the Lyman alpha radiation emitted in each method of detection. The remeasured cross section is found to be in agreement with the Born approximation above 200 eV. The measured ratios are in reasonable agreement with the ratios that would be predicted by the close coupling theory of Burke et al. Author

N70-10644*# Utah Univ., Salt Lake City. Dept. of Electrical Engineering.

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF SOLID-STATE MECHANISMS FOR GENERATING COHERENT RADIATION IN THE ULTRAVIOLET AND X-RAY REGIONS Final Report, 1 Nov. 1968–30 Apr. 1969

P. W. Chen, C. H. Durney, and R. W. Grow 15 Jul. 1969 29 p

(Grant NGR-45-003-027)

(NASA-CR-106563; UTEC-MD-69-086) Avail: CFSTI CSCL 20H

Space charge phenomena in solids are investigated by measuring the microwave impedance of very short semiconductor samples mounted in wave guide circuits. Impedance calculations with one or two kinds of conduction charges show that the practical generation of coherent X-rays by double stream interaction is very unlikely and that main losses in gain are produced by thermal velocities, collisions, transverse ac velocities, and weak coupling. G.G.

N70-10670# International Centre for Theoretical Physics, Trieste (Italy). Miami Univ., Coral Gables, Fla.

E2-PARAMETERIZATION OF SL(2,C)

G. J. Iverson and G. Mack Jun. 1969 11 p refs Submitted for publication Prepared jointly with Miami Univ., Coral Gables

(Grant AF-AFOSR-1288-67)

(IC-69-53) Avail: CFSTI

The E2-parametrization of unimodular 2 × 2 matrices ArSL(2,C) is considered forming a covering of the group of Euclidean motions in the plane. The corresponding factorized matrix elements of the unitary representations of SL(2,C) in an E2-basis are

computed. The results can be used to compute vertex functions in the theory of massless particles with continuous spin.
Author (ESRO)

N70-10678# International Centre for Theoretical Physics, Trieste (Italy).
MATHEMATICAL AND PHENOMENOLOGICAL DUALITY
R. Oehme (Chicago Univ.) Sep. 1969 24 p refs Submitted for publication
(IC-69-107) Avail: CFSTI

The concepts of mathematical and phenomenological duality of binary amplitudes are first considered in the meromorphic limit. It is shown that mathematical duality is essentially a consequence of the requirement of Regge boundedness of all parts of the amplitude in directions not parallel to the real axes. The role of duality in the presence of unitarity branch lines is discussed and the importance of empty outs for the construction of interference-type models is emphasized. The approximate expansion of an amplitude into a finite number of pole terms in all channels simultaneously is explored briefly.
Author (ESRO)

N70-10679# International Centre for Theoretical Physics, Trieste (Italy).
BOOTSTRAP ON TWO-TERM VENEZIANO MODEL WITH UNITARITY
A. M. Harun-Ar Rashid Aug. 1969 10 p refs Submitted for publication Sponsored by Ford Found.
(IC-69-95) Avail: CFSTI

The two-term Veneziano amplitude for pion-pion scattering is investigated to determine its effect on the Yellin-Shapiro inequality for the intercept of the ρ-meson trajectory. Following the proposal of Igi and Storrow, the model combined with unitarity and then a sum rule of Arab and Slansky is made to yield the residue parameters which are found to be in reasonable agreement with previous determinations.
Author (ESRO)

N70-10680# International Centre for Theoretical Physics, Trieste (Italy).
EQUIVALENCE OF LORENTZ TRANSFORMATIONS AND FOLDY-WOUTHUYSEN TRANSFORMATIONS FOR FREE SPINOR FIELDS
J. Tiomno Aug. 1969 30 p refs Submitted for publication Sponsored by Ford Found.
(IC-69-96) Avail: CFSTI

Generalized Lorentz and Foldy-Wouthuysen transformations are introduced. They lead to parametrized forms of the Dirac equation which include, besides the previously known representations, other simple ones which are explicitly given. Equivalence of generalized Lorentz and Foldy-Wouthuysen transformations is proved. It is shown that this is a consequence of the invariance of the Dirac equation. It is also shown that the referred equivalence is connected to the fact that i delta /delta t must be used as a hermitian operator.
Author (ESRO)

N70-10707*# Pittsburgh Univ., Pa. Dept. of Physics.
POLARIZATION OF LYMAN ALPHA RADIATION EMITTED IN ELECTRON COLLISIONS WITH HYDROGEN ATOMS AND MOLECULES
W. R. Ott, W. E. Kauppila, and W. L. Fite 16 Sep. 1969 34 p refs Sponsored in part by NSF
(Grant NGL-39-011-002)
(NASA-CR-106647; SRCC-103) Avail: CFSTI CSCL 20H

The polarizations of Lyman alpha radiation produced by electron impact on atomic and molecular hydrogen, and by electric field quenching of metastable 2S hydrogen atoms have been measured. The polarization analyzer was a lithum fluoride crystal set at the Brewster's angle, with reflected radiation being detected by an iodine vapor photon counter. Generally good agreement between the measured polarization fractions and recent theoretical predictions was found. The radiation produced by quenching metastable atoms in an electron field was found to be polarized with a polarization fraction of $-0.30 + \text{or} - 0.02$ which compared with the theoretical value -0.323.
Author

N70-10708*# Louisiana State Univ., Baton Rouge. Dept. of Engineering Mechanics.
COMPUTER DIFFERENTIATION OF MOESSBAUER SPECTRA
O. W. Albritton and James M. Lewis 1969 42 p refs
(Grant NGR-19-001-024)
(NASA-CR-106646) Avail: CFSTI CSCL 20H

Computer programs have been devised which permit more effective quantitative interpretation of Mossbauer effect spectra. Peaks representing the predominant phase in stainless steels have heretofore overshawdowed peaks representative of minor phases. The computer techniques developed permit differentiation between these data utilizing an iterative, integration, comparison procedure. Additional information concerned with 885 F embrittlement in ferritic stainless steels was obtained.
Author

N70-10743# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
DIFFRACTION MODEL OF HIGH ENERGY LEPTONIC INTERACTIONS
C. A. Piketty and L. Stodolsky Jul. 1969 48 p refs
(Rept-69/47) Avail: CFSTI

Estimates are given for the cross sections for leptonic production of p1, rho and A1 mesons and the total leptonic cross sections using the meson dominance assumptions. The comparison of the predictions with data on deep electroproduction total cross sections provides a partial check of the ideas of the model. Simple experimental implications of the model are given. In addition, independently of the model, the experimental test of the PCAC hypothesis in neutrino scattering at small leptonic momentum transfer does not require a cut-off on the scattering angle, but only in the momentum transfer.
Author

N70-10751# Commissariat à l'Energie Atomique, Bruyères-le-Châtel (France).
CONTRIBUTION TO THE STUDY OF THE MODULATION OF AN ELECTROSTATIC ACCELERATOR BEAM [CONTRIBUTION A L'ETUDE DE LA MODULATION D'UN FAISCEAU D'ACCELERATEUR ELECTROSTATIQUE]
Michel Roche (Ph.D. Thesis) Jul. 1969 141 p refs In FRENCH; ENGLISH summary
(CEA-R-3796) Avail: CFSTI

After a presentation of some aspects of pulsation in an electrostatic accelerator, a more detailed description is given of: 1) modulation of square wave form with the characteristic of very short fronts (1.4×10 to the 9th power sec; 2) regrouping by velocity modulation associated with the preceding method which has made it possible to obtain bursts of 0.45×10 to the 9th power sec. half-way.
Author (ESRO)

N70-10764# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
STUDY OF THE REACTION NEGATIVE PION PLUS PROTON YIELDS POSITIVE PION PLUS NEGATIVE PION PLUS NEUTRON AT 870 MeV [ETUDE DE LA REACTION NEGATIVE PION PLUS PROTON YIELDS POSITIVE PION PLUS NEGATIVE PION PLUS NEUTRON AT 870 MeV]
Janos Zsembery (Ph.D. Thesis--Louvain Univ.) Jul. 1969 56 p refs In FRENCH; ENGLISH summary
(CEA-R-3544) Avail: CFSTI

The + momentum spectrum at various angles was measured from which the distributions of the system were deduced. These

distributions were compared with those obtained by a phenomenological model and this comparison enabled the amplitude of the inelastic waves to be determined. Author (ESRO)

N70-10814# Oak Ridge National Lab., Tenn.
GAMMA-RAY SPECTRA ARISING FROM THERMAL-NEUTRON CAPTURE IN ELEMENTS FOUND IN SOILS, CONCRETES, AND STRUCTURAL MATERIALS
R. E. Maerker and F. J. Muckenthaler Aug. 1969 266 p refs Prepared jointly with Union Carbide Corp. Sponsored in part by DASA
(Contract W-7405-eng-26)
(AD-691903; ORNL-4382) Avail: CFSTI CSCL 18/6

Gamma-ray spectra arising from the capture of thermal neutrons are presented for iron, aluminum, copper, zinc, titanium, nickel, silicon, calcium, potassium, sodium, barium, chlorine, sulfur, and stainless steel. The spectral intensities in photons per 100 captures are presented as both individual lines and as sums of these lines over 0.5-MeV intervals which are intended for use in shielding calculations. The latter results have an estimated accuracy of plus or minus 15%, and include the contributions from both discrete and continuum gamma rays. Comparisons of these spectra are made with previously determined spectra, as well as with values reported in the Reactor Handbook, and considerable revision in the latter is concluded to be necessary. The present results do not go below 1 MeV, but when the relatively small contributions from energies less than 1 MeV are added to them, binding energy checks within plus or minus 5% are obtained. Author (TAB)

N70-10832# Illinois Univ., Urbana. Dept. of Physics
REGGEIZED PION EXCHANGE AND THE 1425-MeV POSITIVE DELTA (1238) RESONANCE NEGATIVE PION ENHANCEMENT IN PROTON PLUS PROTON YIELDS PROTON PLUS PROTON PLUS POSITIVE PION PLUS NEGATIVE PION
D. F. Grether and R. D. Sard 2 Dec. 1968 14 p refs
(Contract AT(11-1)-1195)
(COO-1195-151) Avail: CFSTI

A Reggeized pion exchange model is developed that gives a generally adequate description of the decay mode and decay angular distributions of any substantial resonance contribution to the 1425 MeV enhancement. They do not appear to be consistent with those expected of the resonance of phase shift analysis. Author (NSA)

N70-10833# California Univ., Berkeley. Lawrence Radiation Lab.
POSITIVE KAON-DEUTERON INTERACTIONS NEAR 1 GeV/c
Allan A. Hirata, Charles G.Wohl, Roger W. Bland, Gerson Goldhaber, Bronwyn H. Hall et al Aug. 1968 39 p refs Presented at 14th Intern. Conf. on High Energy Phys., Vienna, 28 Aug.–5 Sep. 1968
(Contract W-7405-eng-48)
(UCRL-18322; Conf-680809-36) Avail: CFSTI

Detailed experimental results on the K(+)d interaction near 1 GeV/c are presented. Measurements on several inelastic cross sections are given, and the I = 0 inelastic cross section KN pi is deduced. The latter corresponds largely to K* production and rises rapidly from 0.860 to 1.210 GeV/c. The results of a phase shift analysis of the charge exchange data up to 0.860 GeV/c are also given. Furthermore the charge exchange data are compared with a Regge model and are found to be consistent with the results of high energy fits. So far an unequivocal answer cannot be given to the crucial question of whether or not a resonance occurs in the I = 0 KN system. Author (NSA)

N70-10838# Oak Ridge National Lab., Tenn.
THE MASKING EFFECT OF MULTIPLE SCATTERING ON THE DETERMINATION OF THE TWO-NUCLEON CORRELATION FROM NEGATIVE PION-ABSORPTION EXPERIMENTS
Hugo W. Bertini 25 Jul. 1969 14 p refs Submitted for publication Sponsored by AEC
(PB-185572; ORNL-TM-2561) Avail: CFSTI CSCL 20H

The absorption reactions of negative pi-mesons by complex nuclei were calculated assuming that the absorptions take place by two-nucleon pairs within the nucleus. The life histories of each nucleon of the absorbing pair and of all particles involved in subsequent collisions within the nucleus are followed using the method of intranuclear cascades. The effects of the exclusion principle, the diffuse nuclear surface, the motion of the bound nucleons, and the nuclear potentials for both pions and nucleons are taken into account in the nuclear model. The results indicate that the ratio of escaping n-n to n-p pairs is considerably different from the ratio of n-p to p-p pairs that initially absorb the negative pi-meson. Author (USGRDR)

N70-10845# Nihon Univ., Tokyo (Japan). Dept. of Physics and Atomic Energy Research Inst.
PLASMA, SOLID STATE, AND THEORETICAL PHYSICS Annual Report for 1968
1968 73 p
(NUP-A-69-3) Avail: CFSTI

CONTENTS:

1. PLASMA PHYSICS M. Yokota, H. Yoshimura, S. Hamada, H. Ohnishi, K. Sato et al p 3–34 refs (See N70-10846 01-25)

2. SOLID STATE PHYSICS K. Yasukochi, K. Sekizawa, T. Ogasawara, N. Usui, M. Ishizuka et al p 35–46 refs (See N70-10847 01-26)

3. THEORETICAL PHYSICS O. Hara, T. Ohmura, K. Izumo, T. Goto, M. Imoto et al p 47–62 refs (See N70-10848 01-24)

N70-10848# Nihon Univ., Tokyo (Japan).
THEORETICAL PHYSICS
Osamu Hara, Takashi Ohmura, Ko Izumo, Tetsuo Goto, Mitsuo Imoto et al *In its* Plasma, Solid State, and Theoret. Phys. 1968 p 47–62 refs (See N70-10845 01-24)
Avail: CFSTI

Activities during this academic year are essentially the continuation and the development of those of the previous year. They include the theory of elementary particles, quantum field theory, and the low energy nuclear physics. Author

N70-10864# Los Alamos Scientific Lab., N.Mex.
TRANSPORT THEORY: FORMULATIONS AND SOLUTIONS BY FINITE DIFFERENCE METHODS
Bengt G. Carlson 29 Oct. 1968 27 p refs
(Contract W-7405-eng-36)
(LA-4016) Avail: CFSTI

The formulation and solution of the neutron transport equation by finite difference techniques is reviewed. The discrete as well as the centered S sub n methods are discussed. Many new results, techniques, and interpretations are presented. The emphasis is on an improved approach to centered S sub n and its generalization. Author (NSA)

N70-10870# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
STUDY OF THE FORM FACTORS OF LEPTONIC DECAYS OF NEUTRAL KAON SUB L [DES FACTEURS DE FORME DES DESINTEGRATIONS LEPTONIQUES DU NEUTRAL KAON SUB L]
Sylvain Zylberajch (Th.D. Thesis–Paris Univ., 30 Apr. 1969) Jul. 1969 156 p refs In FRENCH; ENGLISH summary
(CEA-R-3813) Avail: CFSTI

About 24,000K(o) sub L decays have been observed and studied in a spark chamber. 11,000 K sub e3 and 7,000 K3 decays were identified and their distribution in the Dalitz plot analysed. Author (ESRO)

N70-10957# Eidgenoessiches Institut fuer Reaktorforschung, Wurenlingen (Switzerland).
DECAY RATE OF NEUTRON PULSES IN NON-1/v-POISONED DEUTERIUM OXIDE
T. Doelligast Sep. 1968 68 p refs In GERMAN
(EIR-139) Avail: AEC Depository Libraries

From the decay constant lambda of the thermal neutron flux as a function of the concentration N of an additional non-1/v absorber, the thermalization parameter of a moderator can be obtained. The method is analogous to the diffusion cooling experiment in which lambda was measured as a function of the geometric buckling B(2). If perturbation appears simultaneously in absorption and leakage, the thermalization effects are shown in the deviation of the lambda(N,B(2)) surface from a plane. The absorption perturbation experiment was carried out in D2O as moderator with Sm and Cd as absorber. The spatial modes were isolated by Fourier analysis of the axial pattern of the flux. The use of B as pure 1/v absorber shows that no systematic errors occur. The measurement values for all absorbers used fall in the range of lambda surfaces included by the models. As supplementary products the Maxwell average absorption cross sections of Sm, Cd, and B were obtained. Author (NSA)

N70-10958# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
QUADRUPOLE AND OCTUPOLE ONE-PHONON STATES IN THE REGION 174 LESS THAN OR EQUAL TO A LESS THAN OR EQUAL TO 188
L. A. Malov, V. G. Solovev, and U. M. Fainer 1968 10 p refs In RUSSIAN
(JINR-P4-4073) Avail: AEC Depository Libraries

On the basis of the superfluid nuclear model, the energies of the K(pi) = 0(+), 2(+) quadrupole and K(pi) = 0(-), 1(-), and 2(-) octupole states were calculated as well as the reduced probabilities B(E2) and B(E3). The calculations were performed for the schemes of the one-particle levels and the wave functions of the Nilsson potential with the term <1(2)> with the deformation beta = 0.21 and of the Woods-Saxon potential with the deformation beta = 0.23. Good agreement with experiment was obtained. In calculations based on the Woods-Saxon potential, kappa(2) = 184 A to the minus 7/3 power MeV/cm to the 4th power and kappa(3) = 0.04 A to the minus 4/3 MeV/cm to the 6th power were chosen for the quadrupole and octupole interactions, respectively. B(E2) and B(E3) were calculated for e sub eff = 0.2. The obtained characteristics of the one-phonon states serve as a basis for further study of the deformed nucleus structure. Author (NSA)

N70-10959# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
QUADRUPOLE ONE-PHONON STATES OF EVEN-EVEN NUCLEI IN THE REGION 150 LESS THAN OR EQUAL TO A LESS THAN OR EQUAL TO 174
A. A. Korneichuk, L. A. Malov, V. G. Soloviev, S. I. Fedotov, and G. Schulz 1968 21 p refs Submitted for publication
(JINR-E4-4075) Avail: AEC Depository Libraries

The energies and the wave functions of the two first one-phonon states of the quadrupole type in even-even deformed nuclei are calculated on the basis of the superfluid nuclear model, in the framework of the approximate second quantization method. The one-particle energies and the wave functions of the Woods-Saxon and Nilsson potentials for deformed nuclei are used in the calculations. Some advantages of the calculations based on the Woods-Saxon potential as compared to those based on the Nilsson potential are indicated. It is shown that for the overwhelming majority of nuclei the experimental energies of the first K(pi) = 2(+) states and the corresponding values with the same constant k(2) A(4/3) = 2.5 MeV/sq cm and the effective charge (e sub eef) squared = 0.2 are well described. The characteristics of the one-phonon states serve as a basis for further study of the deformed nucleus structure. Author (NSA)

N70-10960# Institute of Nuclear Research, Warsaw (Poland).
ANTIFERROMAGNETIC ORDERING IN URANIUM MONOARSENIDE AND MONOANTIMONIDE
J. Leciejewicz, A. Murasik, and R. Troc 1968 21 p refs
(INR-P-937) Avail: AEC Depository Libraries

It was found by neutron diffraction that the magnetic structure of Uas at 78 K is of the first kind (I-A) with a saturation moment of 1.93 + or - 0.05 Bohr magnetons. Between 78K and 4K, there is a point of a magnetic phase transition. At 4 K, the magnetic unit cell is doubled in one direction with the moments aligned along the tetragonal unique axis. The sequence of ferromagnetic sheets which are perpendicular to the tetragonal axis is in the order + - - +. The magnetic moment at 4 K is 2.20 + or - 0.05 mu sub B. The magnetic structure of USb both at 4 K and 78 K is of the first kind. The values of the saturation magnetic moments at 4 K and 78 K are 2.16 + or - 0.05 mu sub B and 2.08 + or - 0.05 mu sub B respectively. Author (NSA)

N70-10961# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
EQUILIBRIUM DEFORMATIONS OF THE GROUND AND EXCITED STATES OF THE NUCLEI IN THE RANGE 50 LESS THAN Z, N LESS THAN 82
D. A. Arsenev 1968 46 p refs In RUSSIAN
(JINR-P4-4054) Avail: AEC Depository Libraries

The dependence of the energy of the ground states of the even, odd, and odd-odd nuclei on beta and gamma deformations was calculated for 0 < or = beta < or = gamma < or = 60 deg. The energy, considered as a function of these parameters, has two minima. In the region of Ba-126 deeper minima of some nuclei lie at gamma = 60 deg. When passing from one minimum to another, no essential energy barrier was observed. Therefore these nuclei will be soft with respect to the gamma deformations. Investigation of the behavior of the excited states in these nuclei leads to a conclusion about the presence of the states which are shape isomers. Author (NSA)

N70-10977# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
MEASUREMENT OF THE FRASCATI SYNCHROTRON RADIATION IN THE FAR ULTRAVIOLET REGION
A. Balzarotti (Rome Univ.), M. Grandoleo, and M. Piacentini (Consiglio Nazionale Delle Ricerche, Rome) 6 Mar. 1969 22 p
(ISS-69-13) Avail: CFSTI

The characteristics of the synchrotron radiation emitted by the Frascati electrosynchrotron in the far ultraviolet region are analyzed theoretically and experimentally. The experimental results on the spectral distribution of the radiation and on the transmission of thin aluminum films are presented and discussed. Author

N70-11034# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
A NEW STRUCTURE FOR ACCELERATING HEAVY IONS [UNE NOUVELLE STRUCTURE ACCELERATRICE D'IONS LOURDS]
Jacques Pottier (Ph.D. Thesis-Paris Univ., 5 Jun. 1969) Jul. 1969 246 p refs In FRENCH; ENGLISH summary
(CEA-R-3846) Avail: CFSTI

A new type of accelerating structure with high wave length, high shunt impedance and small size is described which is particularly suited to heavy ions. Its properties are analyzed and compared to those of other structures (more particularly the lines). It is shown that a mode of operation exists for which the shunt impedance in the station mode is worth 80 per cent of its value in the progressive mode. Finally results are given which were obtained with a small experimental apparatus using this structure. Author (ESRO)

N70-11070*# General Electric Co., Schenectady, N.Y. General Physics Lab.

NUCLEAR PARTICLE TRACK IDENTIFICATION IN INORGANIC SOLIDS

R. L. Fleischer, P. B. Price, and R. T. Woods *In its* Radiation Effects 11 Sep. 1969 (See N70-11065 01-24) 11 p refs Avail: CFSTI CSCL 20H

The unique feature of track recording plastics which allows them to be used to identify particles is that the chemical rate of attack V(T) along a track is an increasing function of ionization rate. This same characteristic is shown to extend to inorganic dielectric solids. The relation between V(T) and ionization rate has been measured for five different glasses, using fission fragments of different energies. The variation of V(T) is least for ordinary lime glass and much the greatest for a phosphate glass, suggesting that the latter should be useful in resolving atomic numbers and energies of fission fragments and other very heavy, energetic nuclei. Equations are derived that allow the shapes of etched tracks to be calculated as a function of etching time and particle ionization rate. The calculations agree well with recent experimental results. Author

N70-11071*# General Electric Co., Schenectady, N.Y. General Physics Lab.

ARE FISSION TRACKS IN METEORITES FROM SUPER HEAVY ELEMENTS?

P. B. Price and R. L. Fleischer *In its* Radiation Effects 11 Sep. 1969 11 p refs Submitted for publ. (See N70-11065 01-24) Avail: CFSTI CSCL 20H

The length distribution of binary fission tracks and the low ratio of ternary to binary fission tracks in several meteorites fit the original interpretation of a Pu-244 origin and are inconsistent with an interpretation that they were produced by fission of superheavy elements. Author

N70-11072*# General Electric Co., Schenectady, N.Y. General Physics Lab.

IRON METEORITES: X-RAY ASTERISMS ARE NOT NECESSARILY SHOCK EFFECTS

R. L. Fleischer and P. B. Price *In its* Radiation Effects 11 Sep. 1969 5 p refs (See N70-11065 01-24) Avail: CFSTI CSCL 20H

The X-ray diffraction patterns from kamacite in iron meteorites were suggested as indicators of shock effects. It is shown that the same effects can be produced by slow deformation at low stresses, and that therefore the X-ray data are indicative of deformation but not necessarily of high strain rate deformation. Author

N70-11078# Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany). Electronics Section.

A DISPLAY TERMINAL FOR COMPUTER CONTROLLED NUCLEAR EXPERIMENTS [EIN DATENSICHTGERAET FUER RECHNERGESTEUERTE KERNPYHSIKALISCHE EXPERIMENTE]

J. Zahn Aug. 1969 60 p In GERMAN; ENGLISH summary (HMI-B-83) Copyright. Avail: Issuing Activity

Data are displayed on the display terminal in a 1024 x 1024 dot array by random or sequential point plot (isometric and map display). For controlling the display terminal the data block is preceded by a control word. Linear or logarithmic display, superposition of a graticule, stretching of the x coordinate, differential discrimination of data in the sequential display mode, and data input by light pen are possible. Author

N70-11079# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.

FACTORIZATION AND DEGENERACY OF THE HADRON SPECTRUM IN VENEZIANO MODEL

M. Cassandro (Rome Univ) and L. Maiani 24 Jun. 1969 9 p refs (ISS-69-25) Avail: CFSTI

Factorization properties of the Veneziano amplitude for the two body scattering of spinless particles are investigated. Consistency is found only if one allows for degenerate daughter levels. In the scattering of particles belonging to the same SU(3) multiplet, strict factorization is obeyed at all daughter poles, to first order in mass differences. This is interpreted as a non renormalization property (from the SU(3) symmetric values) of the coupling constants of the degenerate resonances. Author

N70-11092# Gulf General Atomic, San Diego, Calif.

MEASUREMENT OF NEUTRON PENETRATION STANDARDS. VOLUME 2: HIGH RESOLUTION MEASUREMENTS OF THE TOTAL NEUTRON CROSS SECTIONS OF NITROGEN AND IRON Final Technical Report

A. D. Carlson, R. J. Cerbone, and D. F. Willoughby 27 Mar. 1969 123 p refs (Contract DA-49-146-XZ-482) (AD-689840; DASA-2289-Vol-2) Avail: CFSTI CSCL 18/6

A comprehensive study has been made of the neutronic behavior in iron. The research comprised measurements of the neutron angular flux spectrum from approximately 1 keV to 10 MeV in a 76.2-Cm-diameter iron sphere, the gamma-ray spectrum from 0.20 to 10.0 MeV in the same bulk assembly, and the gamma-ray time distribution. In addition, the total cross section of iron has been measured from 0.5 MeV to 10 MeV with a 0.035 NSEC/M resolution. The neutron angular flux spectra are compared to a series of discrete-ordinates transport calculations using endf/b, p3 cross sections in both 29- and 49-group representations. Both calculations indicate that the present endf/b data for iron are wrong by as much as fifty percent in some energy regions. Author (TAB)

N70-11121# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

COVARIANT STRUCTURE OF THE TWO-POINT FUNCTION

A. I. Oksak and I. T. Todorov 1968 39 p refs In RUSSIAN (JINR-P2-4115) Avail: AEC Depository Libraries

The spectral representation of the two point function for arbitrary fields proposed recently is rigorously proved and analyzed. The problem is treated in momentum space where the covariant structure is simpler because of the spectrum conditions. For finite component fields the general covariant structure is found in coordinate space too and is applied to the definition of time-ordered Green functions for arbitrary spin. The decomposition of the two point function into kernels of definite spin is proved and a necessary and sufficient condition for the growth of the coefficients of this decomposition is given. The formalism of homogeneous distributions in two dimensional complex space is used throughout. Author (NSA)

N70-11122# Sandia Corp., Albuquerque, N.Mex.

ON THE REFLECTION COEFFICIENT OF A PLASMA PROFILE OF EXPONENTIALLY TAPERED ELECTRON DENSITY AND FIXED COLLISION FREQUENCY

Charles W. Harrison, Jr. and Rondall E. Jones 13 Nov. 1968 9 p (SC-R-68-3907) Avail: CFSTI

The reflection coefficient is found at an arbitrary point within a plasma profile of exponentially tapered electron density and fixed collision frequency. To facilitate the analytical solution of the

problem it is found advantageous to terminate the profile in a perfectly conducting plate. This artifice has little physical significance if the plate is positioned in the region of reflection where the electromagnetic field is negligible. But there is some indeterminancy in locating this region. In the present analysis the plate is located at the level of electron density where the magnitude of the complex relative dielectric constant passes through a minimum or where the real dielectric constant goes through zero since, in the region of these points, the electromagnetic field is evanescent. Reflection factors for both plate locations are computed and compared. Evidently when the plate is positioned at the lower electron density the magnitude of the reflection coefficient is larger, so that an upper bound on the size of the coefficient is established.

Author (NSA)

N70-11192# International Centre for Theoretical Physics, Trieste (Italy).

EQUAL TIME COMMUTATORS OF SPATIAL COMPONENTS OF AXIAL CHARGES AND CORRESPONDING SUM RULES

G. J. Komen and S. Pallua Aug. 1969 22 p refs Submitted for publication Sponsored in part by Neth. Organ. for Advan. of Pure Res.

(IC-69-94) Avail: CFSTI

A set of sum rules is derived by saturating the equal-time commutator of integrated space components of axial currents between nucleon states at rest. The relation of these sum rules to the SU(6) results is discussed. Author (ESRO)

N70-11198# California Inst. of Tech., Pasadena. Comitato Nazionale Per l Energia Nucleare, Frascati (Italy).

ANALYTICITY, FACTORIZATION, AND LORENTZ SYMMETRY

P. di Vecchia and F. Drago Sep. 1968 20 p refs Presented at the Conf. on Hadron Spectry, Neszthely, Hung., Sep. 1968 Prepared by Calif. Inst. of Tech.

(Contracts F61052-67-C-0084, AEC AT(11-1)-68)

(CALT-68-174) Avail: CFSTI

The scattering amplitude at t = 0 is reconstructed for the process N + N yields N + N due to the exchange of a Regge pole family with a defined value of the Toller quantum number M. The complete equivalence is shown between the group-theoretical and the analytical approach at t = 0 in the equal mass configuration. NSA

N70-11199# Hungarian Academy of Sciences, Budapest.

A UNIFIED THEORY OF THE COMPOUND AND THE INTERMEDIATE RESONANCES

T. Dolinszky 1968 21 p refs

(KFKI-28-1968; Rept-23-7330) Avail: AEC Depository Libraries

To account for the compound resonances that are usually averaged out in the theories of the intermediate structure but extractable from recent detailed high resolution measurements covering a wide energy range, the interior contribution to the transition matrix is factorized into a regular and an irregular function of energy. While the latter is expanded in terms of the poles in the energy plane, the former is developed into a series with energy-dependent shell-model eigenvalues, belonging to excitations of various complexity, in the energy denominators. This formula also implies, apart from the simultaneous exhibition of the compound levels and the doorway structure, the approximate zeros of the partial cross section. A systematic shift between the partial cross-section zeros in elastic scattering and the proper poles establishes a connection between the regular factor as well as the pole factor and gives rise to an arrangement of the compound levels among the optical resonances. Author (NSA)

N70-11209# International Centre for Theoretical Physics, Trieste (Italy).

SPIN AND D-STATE EFFECTS ON HIGH-ENERGY ELASTIC SCATTERING OF PIONS ON He3

H. Baier and V. K. Samaranayake Aug. 1969 17 p refs Submitted for publication Sponsored jointly by UNESCO and IAEA

(IC-69-99) Avail: CFSTI

Using Glauber multiple scattering theory, the spin and D-state effects on elastic pion-helium(3) scattering at .826 and 2.01 GeV/c and small momentum transfer are investigated. Spin effects are shown to be important at the lower energy and the effect of the D-wave component in the ground state wave function is found to be small. This is contrary to the deuteron results where this is attributed to be the cause of the filling of the dip in the differential cross-section. Author (ESRO)

N70-11210# International Centre for Theoretical Physics, Trieste (Italy).

ELASTIC SCATTERING OF LOW-ENERGY PIONS BY ALPHA PARTICLES

A. M. Harun-Ar Rashid and V. K. Samaranayake Aug. 1969 26 p refs Submitted for publication Sponsored in part by Ford Found.

(IC-69-103) Avail: CFSTI

The low-energy pion-alpha particle elastic scattering is investigated using Schwinger's variational expression for the T-matrix. The method allows the simple evaluation of double scattering effects. The results of the calculation are compared with the available experimental data. Author (ESRO)

N70-11221# Cambridge Electron Accelerator, Mass.

CEA SECONDARY EMISSION MONITORS

George F. Dell and Mircea Fotino 4 Nov. 1968 42 p refs

(Contract AT(30-1)-076)

(CEAL-1045) Avail: CFSTI

The response of aluminum and gold secondary emission monitors has been measured from 1.5 to 18 GeV for electrons and at 6 and 11 GeV for positrons. The secondary electron yield in a positron beam was found to be 1 to 3% larger than in an electron beam. Dependence of SEM response on the angle of the beam from normal incidence was found to vary as sec theta. For energies below 8 GeV, the response of both types of monitors varies nearly as ln(E). However in the range 1.5 to 18 GeV, the deviation from a ln(E) dependence is 6.8% for gold and 31% for aluminum. Whereas Aggson predicts that the energy dependence results from the upstream foil surfaces and that departure from a ln(E) dependence is a consequence of finite foil spacing, Bakhshyan and Garibyan assert that the energy dependence results either from the total absence of the density effect in thin dielectric layers or at least from an increase in the energy at which the density effect becomes significant in thin dielectric layers. Tests of these assertions are still to be made. Author (NSA)

N70-11223# California Univ., La Jolla.

ELECTROMAGNETIC INTERACTIONS: THEORY

N. M. Kroll Sep. 1968 37 p refs Presented at 14th Intern. Conf on High Energy Phys., Vienna, 28 Aug.–5 Sep. 1968

(Contract AT(11-1)-Gen-10)

(UCSD-10-P-10-48; Conf-680809-38) Avail: CFSTI

The discussion is devoted mainly to the following topics: the asymptotic behavior of form factors as evidence of composite structure; excitation of resonances in inelastic electron-proton scattering; inelastic electron-proton scattering at high energies and the Bjorken sum rule; vector dominance in the electromagnetic interactions of hadrons; and electromagnetic mass differences in isotopic multiplets. NSA

N70-11259# International Centre for Theoretical Physics, Trieste (Italy).
SO PLUS (n,1)-INVARIANT FINITE-COMPONENT WAVE EQUATIONS AND REFLECTION INVARIANCE
P. M. Mathews Jul. 1969 14 p refs Submitted for publication
(IC-69-81) Avail: CFSTI

First order finite-dimensional equations of the generalized Bhabha type in a space with n spacelike and one time-like dimensions are considered. It is observed that invariance under the connected part SO+(n,1) of the pseudo-orthogonal group in this space requires the use of a wave function transforming according to a representation of the larger group SO+(n+1, 1). It is shown that though the wave function (and each part of it obtained by reduction with respect to SO+(n, 1) transforms into itself under the strong reflection R also, nevertheless the wave equation in an odd-dimensional space (n+1 = 2k+1) may or may not be invariant under R when the wave function employed transforms irreducibly under the connected group SO+(n+1, 1). Thus, contrary to the suggestion contained in the recent literature where specific equations are considered the mere fact of oddness of the dimension of the space does not force the use of representations reducible with respect to the latter group –the matter is representation-dependent. It is shown, however, that irrespective of the representation used and of the dimension of the space, the equation is invariant under a transformation θ defined as a combination of an improper transformation reversing the sign of time and another improper transformation of reflection in any hyperplane in the space-like variables. It is suggested that TCP in an arbitrary space be identified with θ rather than with R which simply reverses the sign of all co-ordinates. Author (ESRO)

N70-11270# International Centre for Theoretical Physics, Trieste (Italy).
THE PION ELECTROMAGNETIC FORM FACTOR AND THE VENEZIANO MODEL
A. Amatya and M. O. Taha Jun. 1969 13 p refs Submitted for publication
(IC-69-55) Avail: CFSTI

Elastic unitarity is used to connect the pion electromagnetic form factor to the pi pi Veneziano amplitude. A model for the form factor exhibiting this connection is obtained. It is in fair agreement with experiment. Author (ESRO)

N70-11272# International Centre for Theoretical Physics, Trieste (Italy).
DIRECT CHANNEL FERMION REGGE POLES
I. A. Sakmar Jun. 1969 26 p refs Submitted for publication Sponsored in part by Natl. Res. Council of Can.
(IC-69-52) Avail: CFSTI

The assumptions made in the identification of direct channel Regge pole terms with the resonance amplitudes are examined. The numerator function as well as the denominator are expanded without assuming the smallness of the imaginary part of alpha. It is shown that in the calculation of Im alpha the assumptions may not always be satisfied. The differential cross-sections at typical resonances are calculated taking into account the contributions of the parity reflected states and daughters. Author (ESRO)

N70-11298# International Centre for Theoretical Physics, Trieste (Italy).
THE VERY HIGH ENERGY LIMIT OF PROTON-PROTON SCATTERING
A. O. Barut and W. Plywaski Aug. 1969 19 p refs Submitted for publication Sponsored in part by US AFOSR
(IC-69-106) Avail: CFSTI

The contact interaction between the protons using the vector currents and wave functions provided by the relativistic O(4,2) model has been evaluated. The resulting enveloping differential cross-section at s = infinity is discussed and compared with experiments over the entire range of accessible momentum transfer values. Author (ESRO)

N70-11316 Fordham Univ., New York.
BRILLOUIN SCATTERING IN RUTILE
Camille Minichino (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-2599

The Brillouin spectrum of a single crystal of rutile was photographed at room temperature in the 9th order of a high-resolution grating spectrograph, using the Ne 6328 A line from a helium-neon gas laser for excitation. The measured Brillouin shifts, of the order of 1 wavenumber unit, were used to calculate the velocities of the scattering thermal phonons in three directions. The average velocities obtained experimentally for this region, the region of hypersonic frequencies, are given for phonon direction (1,0,0): phonon direction (1/2, −1/2, −1/square root of 2; and phonon direction (−1/2 − 1/2 square root of 2, −1/2 + 1/2 square root of 2, −1/2). The velocities correspond to the longitudinal and two transverse acoustic waves, respectively. Dissert. Abstr.

N70-11328# International Centre for Theoretical Physics, Trieste (Italy).
TOPICAL CONFERENCE ON DYNAMICAL GROUPS AND INFINITE MULTIPLETS
A. O. Barut, ed. and P. Budini, ed. Jun. 1969 59 p refs Conf. held at Trieste, Italy, 9–14 Jun. 1969
(IC/69/54) Avail: CFSTI

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16. THE CONTINUOUS BAKER-CAMPBELL-HAUSDORFF FORMULA AND F-ORDERINGS J. Plebanski (Warsaw Univ.) p 42–44 refs (See N70-11339 01-24)

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N70-11327# Centre National de la Recherche Scientifique, Marseilles (France). Centre de Physique Théorique.

LIE GROUPS AND SYMPLECTIC MANIFOLDS

H. Bacry *In* Intern. Centre for Theoret. Phys. Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 1–4 refs (See N70-11326 10-24)

Avail: CFSTI

In the search for unitary representation of Lie groups, a theorem on symplectic manifolds is derived. The consequences of this theory in classical mechanics and quantization are discussed so that e.g. a photon appears as the particle of a 'geometrical optics' involving polarization and color. ESRO

N70-11328# International Centre for Theoretical Physics, Trieste (Italy).

DYNAMICAL GROUPS, INFINITE MULTIPLETS AND MODEL OF HADRONS

A. O. Barut (Colorado Univ., Boulder) *In its* Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 5–11 refs (See N70-11326 01-24)

Avail: CFSTI

An understanding is developed of the properties of hadrons by means of the methods of infinite multiplets and dynamical groups, by which the atomistic treatment (constituents and interactions) is replaced by a single system possessing internal degrees of freedom. Transitions in single composite systems due to weak and electromagnetic interactions, scattering and annihilation problems are treated and some conclusions are drawn concerning extra solutions of the Bethe-Salpeter equation. ESRO

N70-11329# International Centre for Theoretical Physics, Trieste (Italy).

RELATIVISTIC CORRECTIONS TO A VERTEX FOR COMPOSITE SYSTEMS

P. Budini and G. Calucci (Ist. Nazl. Fis. Nucl., Trieste, Italy). *In its* Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 12–14 refs (See N70-11326 01-24)

Avail: CFSTI

The connection between the covariant vertex which can be deduced from a Majorana-type equation representing a composite system with non-relativistic internal motion, and the vertex which can be deduced for the same system with standard field-theoretical methods is discussed. At low momentum transfer, relativistic corrections can easily be accounted for but at high momentum transfer retardations in the binding forces become important. ESRO

N70-11330# Max-Planck-Institut für Physik and Astrophysik, Munich (West Germany).

PHYSICAL IMPLICATIONS OF A NEW QUANTUM NUMBER DERIVED FROM CONFORMAL INVARIANCE

L. Castell *In* Intern. Centre for Theoret. Phys. Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 15–16 refs (See N70-11326 01-24)

Avail: CFSTI

Conclusions are drawn from the invariance of relativistic field equations for particles with zero mass and discrete spin under dilatations and special conformal transformations, leading to either a new multiplicative quantum number, or the existence of certain particles with zero mass. ESRO

N70-11331# Institute for Advanced Study, Princeton, N. J.

PROPERTIES OF CURRENT ALGEBRA AT INFINITE MOMENTUM AND ITS RELATIONS TO INFINITE-COMPONENT WAVE EQUATIONS

Shau-Jin Chang (Illinois Univ.) *In* Intern. Centre for Theoret. Phys. Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 17–19 refs (See N70-11326 01-24)

Avail: CFSTI

Assuming satisfaction of the Fubini-Dashen-Gell-Mann sum rule and a sharp resonance approximation, the saturation of current algebra at infinite momentum is analysed. It is found that all solutions to this simplified problem are related to infinite-component wave equations and that the mass spectrum is pathological in several respects. ESRO

N70-11332# International Centre for Theoretical Physics, Trieste (Italy).

NEW METHODS FOR THE COULOMB PROBLEM

C. Fronsdal (Calif. Univ., Los Angeles) *In its* Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 21–23 refs (See N70-11326 01-24)

Avail: CFSTI

By using a unitary, irreducible representation of SO(4,2) and a wave function differing from the Schrödinger wave function, its r-dependence being suppressed, an algebraic approach to problems involving the Coulomb interaction is developed. The matrix element for Compton scattering from bound electrons, Coulomb scattering, photo effect, bremsstrahlung, and radiative capture are derived by this method. ESRO

N70-11333# International Centre for Theoretical Physics, Trieste (Italy).

THE RELATIVISTIC TWO-BODY PROBLEM

C. Fronsdal *In its* Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 24–25 refs (See N70-11326 01-24)

Avail: CFSTI

It has been found that an ad hoc equation of the Majorana type, representing two interacting scalar particles can be derived from quantum field theory following the approach by Logunov and Tavkhelidze. It is concluded that some infinite component c-number field theories are better approximations to quantum field theory than the Bethe-Salpeter equation. ESRO

N70-11334# International Centre for Theoretical Physics, Trieste (Italy).

SATURATION OF CURRENT ALGEBRA

C. Fronsdal *In its* Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 26–27 refs (See N70-11326 01-24)

Avail: CFSTI

In analogy to the saturation of Gell-Mann current algebras by finite component Lagrangian field theories, infinite component theories are investigated to see whether this is true for them also. It is found that a Lagrangian c-number field theory provides model saturation under very weak conditions, a theory with a discrete mass spectrum does not give a local current algebra, and theories with mixed spectra do provide model saturations. ESRO

N70-11335# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Neutronenphysik und Reaktortechnik.
THE GROUP THEORETICAL STRUCTURE OF THE STRONG-COUPLING THEORY
H. Jahn *In* Intern. Centre for Theoret. Phys. Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 29–31 refs Submitted for publication (See N70-11326 01-24)
Avail: CFSTI

The group-theoretical structure of the symmetrical scalar fixed source meson theory is investigated, splitting the Hamiltonian and checking whether the interaction between the bound and the free part vanishes at an infinite coupling constant. This limit can only be verified if the vibrational degrees of freedom are suitably eliminated. ESRO

N70-11336# Institute of Theoretical Physics, Goeteborg (Sweden).
FIELDS ON A HOMOGENEOUS SPACE DESCRIBING AN INFINITE NUMBER OF PARTICLES
A. Kihlberg *In* Intern. Centre for Theoret. Phys. Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 32–34 refs (See N70-11326 01-24)
Avail: CFSTI

A field theoretical approach to describe hadron physics, using spaces larger than a Minkowski space leads to the definition of wave functions describing particles, after which it is possible to define free fields using creation and annihilation operators. Fermion-fermion scattering is treated as an example. ESRO

N70-11337# Miami Univ., Coral Gables, Fla. Center for Theoretical Studies.
MASSLESS PARTICLES WITH CONTINUOUS SPIN
G. Mack *In* Intern. Centre for Theoret. Phys. Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 35–37 refs (See N70-11326 01-24)
Avail: CFSTI

A class of mass zero representations from the quantum mechanical Poincaré group is used to describe elementary particles. The most interesting result is that a (PCT-invariant) interaction involving continuous spin neutrinos can be found approaching the theory of leptonic weak interactions. ESRO

N70-11338# Paris Univ., Orsay (France). Laboratoire de Physique Theorique et Hautes Energies.
REMARKS ON WAVE FUNCTIONS AND FIELDS ON HOMOGENEOUS SPACES OF THE POINCARE GROUP
J. Nuyts *In* Intern. Centre for Theoret. Phys. Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 39–41 refs (See N70-11326 01-24)
Avail: CFSTI

In order to describe particle spin analogously to mass, the unitary irreducible representations of the Poincaré group might be realized as complex valued representations. Less fundamentally, the free Hamiltonian describes an infinite idealized set of zero width resonances, the continuous degeneracy of which may represent the mass distribution in the real world. ESRO

N70-11339# Warsaw Univ. (Poland). Inst. of Theoretical Physics.
THE CONTINUOUS BAKER-CAMPBELL-HAUSDORFF FORMULA AND F-ORDERINGS
J. Plebanski *In* Intern. Centre for Theoret. Phys. Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 42–44 refs (See N70-11326 01-24)
Avail: CFSTI

In physics and mathematics an algorithm for the evolution operator in associative algebra is of interest, related to the Baker-Hausdorff problem. It appears that the F-orderings can be composed according to the rules of the natural algebra, and some represent idempotent orthogonal operations. ESRO

N70-11340# Institute of Nuclear Research, Warsaw (Poland).
OPERATOR DISTRIBUTIONS IN GROUP REPRESENTATION THEORY AND THEIR APPLICATIONS
R. Raczka *In* Intern. Centre for Theoret. Phys. Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 45–50 refs (See N70-11326 01-24)
Avail: CFSTI

A method, leading to information on interactions, of classifying two-particle states of two scalar relativistic interacting particles and solutions of certain operator equations is derived in group representation theory, assuming a locally compact type I Lie group. ESRO

N70-11341# Syracuse Univ., N. Y. Dept. of Physics.
QUANTUM THEORY OF THE GENERALIZED WAVE EQUATION AND THE PROBLEM OF SPIN STATISTICS
K. C. Tripathy *In* Intern. Centre for Theoret. Phys. Topical Conf. on Dyn. Groups and Infinite Multiplets Jun. 1969 p 51–55 refs Supported in part by AEC (See N70-11326 01-24)
Avail: CFSTI

The breakdown of spin-statistics relations, the invalidity of the CPT theorem and redundant solutions is discussed in finite-component field theories. A systematic quantization scheme for infinite-component fields is developed which is compatible with locality. ESRO

N70-11384# Cambridge Electron Accelerator, Mass.
CAMBRIDGE ELECTRON ACCELERATOR Semiannual Report, 1 Jan. – 30 Jun. 1968
Karl Strauch 25 Oct. 1968 33 p refs
(Contract AT(30-1)-2076)
(CEAL-1044) Avail: CFSTI

Development and operation of the 6-GeV electron accelerator are presented. The various guiding committees are listed, and the high-energy experiments in progress or in preparation are outlined. The progress made on Project Bypass is summarized, and the status of the on-line detector for the colliding beam experiment and the magnetic design are described. Radiation safety is also discussed, and major publications are listed. NSA

N70-11367# International Centre for Theoretical Physics, Trieste (Italy).
SYMMETRY BREAKING AND CURRENT DIVERGENCES BELONGING TO (3,3 STAR) PLUS (3 STAR, 3) AND ETA MESON DECAY INTO 3 PIONS
A. Q. Sarker Aug. 1969 11 p refs Submitted for publication
Sponsored by Fund for Phys. for Develop. Countries
(IC-69-100) Avail: CFSTI

Through the pole model the decay $\eta \rightarrow 3\pi$ is related to the $\pi\pi$ and $\pi\eta$ scattering processes, which are then evaluated with the assumption of PCAC, soft pion (eta) limits and the symmetry-breaking Hamiltonian and current divergences belonging to the $(3,3^*) + (3^*,3)$ representation of SU(3) $\otimes$ SU(3). Author (ESRO)

N70-11369# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
THE INELASTIC SHIELDING EFFECT
L. Stodolsky 1969 21 p refs
(Rept-69/56) Avail: CFSTI

Described is an optical approach for calculating the inelastic shielding effect in the scattering of a particle from a multi-body system such as an atomic nuclei. The strength of the shielding intersection is characterized by its free mean path according to the

density of the nucleons and the total cross section for the incoming particle. By representing the incident plane wave and the scattered spherical wavelets coming from the nucleons, the shielding is viewed as coming from the interference of the forward scattered wavelets with the incident plane wave. By relating the imaginary part of the forward amplitude to the total cross section the momentum is determined and the damping probability of the shielding effect is determined. G.G.

N70-11371# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.

MEASURED HIGH-ALTITUDE NEUTRON AND GAMMA DOSE DISTRIBUTIONS DUE TO A 14-MeV NEUTRON SOURCE

A. E. Fritzsche, N. E. Lorimier, and Z. G. Burson 26 May 1969 46 p refs Sponsored by AEC
(PB-185524; EGG-1183-1438; TR-L-943) Avail: CFSTI CSCL 18H

The most important distribution to be obtained was one that could be considered due to a source in an infinite medium of air. The neutron and gamma tissue dose distributions show that the ground appears to progressively reduce the neutron and gamma dose as the source approaches the ground. The dose distributions with the source at 1125 ft and detector at 1000 ft are a close approximation to those expected from a source in an infinite medium of air. Theoretical calculations of these distributions are 28 percent larger than those measured for neutron dose and 22 percent larger than gamma dose. Neutron-to-gamma dose ratios generally decrease from a factor of 4 at 1000 ft to a factor of about 1.5 at 4000 ft. A helicopter utilizing a radar range finder and barometric altimeter was used as a stable platform to obtain the measurements. Author (USGRDR)

N70-11374# European Organization for Nuclear Research, Geneva (Switzerland).

A SELECTION OF FORMULAE AND DATA USEFUL FOR THE DESIGN OF A G SYNCHROTRONS

C. Bovet, G. S. Cohen, R. Gouiran, I. Gumowski, K. H. Reich et al 1 Oct. 1968 55 p refs
(MPS-SI/Int-DL/68-3) Avail: AEC Depository Libraries

Some basic relations including particle velocity, momentum, and energy; energy available in collision between two particles; magnetic and electric deflection; and some formulas for quantities related to synchrotrons are presented. Transverse phase space methods are outlined including matrix formulation of beam dynamics, single particle motion in a synchrotron, ellipse representation in transverse phase space, closed orbit, effects of various focusing perturbations on the frequency and amplitude of betatron oscillations, and space charge limit. Longitudinal phase space considerations include accelerating voltage, accelerating frequency, synchrotron oscillations, and debunching. Also, relations for magnets, ferrite-loaded RF accelerating cavities, and vacuum pressures required are given. Author (NSA)

N70-11392# Oak Ridge National Lab., Tenn. Isotopes Information Center.

USES OF NEUTRON RADIOGRAPHY: A LITERATURE REVIEW

Martha Gerrard Oct. 1968 20 p refs
(Contract W-7405-eng-26)
(ORNL-IIC-16) Avail: CFSTI

The literature on neutron radiography is reviewed with special emphasis on uses and radioisotope sources. (NSA)

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N70-10027*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.

ABSOLUTE AND CONVECTIVE MICROINSTABILITIES OF A MAGNETIZED PLASMA

James D. Callen (Ph.D. Thesis) Apr. 1968 509 p refs
(Grant NSG-496)
(NASA-CR-94641; CSR-T-68-3) Avail: CFSTI CSCL 20I

The electrostatic instabilities of a low beta, weakly inhomogeneous, hot, fully ionized collisionless plasma in a magnetic field are considered. Some discussion of the values of beta for which only electrostatic modes need be considered, of the restrictions which are imposed by equilibrium considerations on any magnetic field curvature which may be present and of the local approximation to the integro-differential dispersion equation is given. Rigorous necessary and sufficient conditions for instability of the plasma are derived. These conditions extend those previously available for homogeneous plasmas to weakly inhomogeneous plasmas, and in general justify and elucidate the commonly used marginal stability analysis. The problem of distinguishing between convective and absolute instabilities is reviewed. A new and very efficient method for determining the density at which an absolute instability of the plasma has any given temporal growth rate, including zero, is developed. Author

N70-10102*# Columbia Univ., New York. School of Engineering and Applied Science.

THE INTERACTION OF A SATELLITE WITH THE IONOSPHERE

Stephen M. Call 1969 197 p refs
(Contracts NGR-33-008-007; AF 49(638)-1634)
(NASA-CR-106555; Rept-46) Avail: CFSTI CSCL 20I

Poisson – Vlasov equations are used to solve the interactions between a satellite and the ionosphere. The self-consistent electric field is obtained by means of an iteration technique which cycles between the ion density and potential calculations. The current – voltage characteristics are computed as functions of satellite velocity, ion mass, electron temperature, and satellite shape and size. The floating potential and the plasma drag of the satellite, the angular distribution of the ion current to a cylindrical satellite, the detailed structure of the wake, and the wake length and ion focusing in the wake are studied. The satellite interaction with the ionosphere is examined without the effect of an ambient magnetic field. This interaction includes a uniform magnetic field. A magnetic field oriented parallel to the flow velocity has a much greater influence on the subsequent motion of the ions in the wake than a field of equal magnitude oriented perpendicular to the flow velocity. Author

N70-10155# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.

THE EFFECT OF A MAGNETIC FIELD ON DISCHARGE PLASMAS AND ION LASERS

John H. Keller and Richard W. Grow Nov. 1968 142 p refs
(Grants NSF GK-29; NSF GK-1644)

(PB-183753; UTEC-MD-68-102; NSF-19) Avail: CFSTI CSCL 20I

Theoretical descriptions are obtained for the effects of both uniform and nonuniform magnetic fields on discharge plasmas and ion lasers. These theories include a comprehensive derivation of nonlinear ambipolar diffusion theory including the effects of charge separation and ion acceleration, the effect of a uniform magnetic field on the plasma when the ion mean free path is approximately equal to or less than the tube radius, and the effect of a nonuniform magnetic field. Applications of the theory are made to ion lasers and to the design of more efficient and/or higher power argon lasers. Special attention is given to the design of an ion laser which uses widely-spaced segments and a magnetic field to confine the plasma. The experimental results obtained with the laser show that this design should produce more efficient 4 and 5 mm bore ion lasers and also show a need for larger than normal gas return paths. Calculations indicate that the efficiency may be increased by a factor of 2.5 by using widely-spaced segments and a magnetic field to confine the plasma in an ion laser. Author (USGRDR)

N70-10159*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.

MEASUREMENT OF NO PLUS PLUS E MINUS DISSOCIATIVE RECOMBINATION IN EXPANDING AIR FLOWS

Michael G. Dunn and John A. Lordi Sep. 1968 40 p refs

(Contract NAS5-9978)

(NASA-CR-106554; CAL-AI-2187-A-10) Avail: CFSTI CSCL 20I

The dissociative-recombination reverse rate coefficient for the reaction NO(+) + yields N + O was measured in the inviscid nozzle flow of a short duration reflected shock tunnel and found to be equal to (5.4 + or - 0.9) × 10 to the 21st power T sub e to the minus 1.5th power cu cm/mole sec for an electron temperature range of approximately 2000 K to 7000 K. These experiments were performed in air at equilibrium reservoir conditions of 6850 K and 22 atm pressure and at 7200 K and 25 atm pressure. Thin wire Langmuir probes were used to measure the electron temperature and electron density on the nozzle centerline. The electron densities were simultaneously measured using microwave interferometers and found to be in good agreement with the values obtained from the Langmuir probe data. The measured electron temperatures, which were considerably greater than the calculated heavy particle translational temperature, were used in determining the reverse rate coefficient from the number density data. Author

N70-10211# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PHYSICAL GAS DYNAMICS OF IONIZED AND CHEMICALLY REACTIVE GASES Selected Articles

12 Jun. 1969 24 p refs Transl. into ENGLISH from Fiz. Gazodinam. Ionizirovannykh. Khim. Reagiruyushchikh Gaz., Akad. Nauk SSSR, Energ. Inst. (Moscow), 1968 p 29-35 and 36-39

(AD-692147; FTD-MT-24-80-69) Avail: CFSTI CSCL 20/9

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2. INVESTIGATION OF DENSE PLASMA RADIATION OBTAINED BY MEANS OF AN EXPLODING WIRE IN A VACUUM A. P. Ryazin et al p 13-18 refs (See N70-10213 01-25)

N70-10212# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIMENTAL INVESTIGATIONS OF BREMSSTRAHLUNG IN NEUTRAL COMPONENTS OF AIR AND NITROGEN

Yu. A. Plastinin *In its* Phys. Gas Dyn. of Ionized and Chemically Reactive Gases 12 Jun. 1969 p 1-12 refs (See N70-10211 01-25)

Avail: CFSTI

The effective bremsstrahlung absorption cross section of the neutral components of air and nitrogen was investigated in the reflected shock region of a double-diaphragm shock tube. Shock velocities range from 3000-4000 m/sec T sub 5. Air varied from 6200 K to 7400 K and T sub 5, N2 was 7100 K. The pressure behind the reflected shock varied between 25-38 atmospheres. Measurements were made with a single-channel spectrometer fitted with an IR receiver. The theoretical values for N and N2 were, respectively, 2.0 and 1.5-5.4 times 10 to the minus 38th power cm to the 5th power. Author

N70-10213# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF DENSE PLASMA RADIATION OBTAINED BY MEANS OF AN EXPLODING WIRE IN A VACUUM

A. P. Ryazin et al *In its* Phys. Gas Dyn. of Ionized and Chemically Reactive Gases 12 Jun. 1969 p 13-18 refs (See N70-10211 01-25)

Avail: CFSTI

The initial stages of a wire explosion are studied spectrographically. Synchronously with the electric characteristics of the exploding wire, the radiation spectra of the resulting plasma are obtained as a function of time. The maximum energy transferred from the condenser to the wire is estimated to be 362 joules. The continuum spectra are shown graphically as relative energy distribution plotted as a function of wavelength. A black body radiation estimate puts the plasma temperature at 50,000K. Author

N70-10377# California Univ., Berkeley. Div. of Aeronautical Sciences.

AN EXPERIMENTAL STUDY OF THE SHOCK STRUCTURE IN A PARTIALLY IONIZED GAS

Robert H. Kirchhoff Apr. 1969 113 p refs

(Grant AF-AFOSR-538-68)

(AD-691269; AS-69-8) Avail: CFSTI CSCL 20/9

Shock structure experiments were carried out in a radio frequency heated, steady state, low density, partially ionized argon plasma jet. The primary diagnostic tool was the aligned cylindrical free molecule Langmuir probe used to probe a normal shock wave. Spatial resolution was 13% of the heavy particle shock thickness, thus details of electron temperature, ion number density, and plasma potential are available through the shock. The electron temperature rise was observed to precede the heavy particle shock. The plasma potential converted from floating potential according to the theory of Laframboise was in substantial agreement with changes in plasma potential obtained from a numerical quadrature of the generalized Ohms Law assuming zero current. A quantitative explanation of the dark space observed to precede partially ionized gas shocks is provided by comparing the collisional-radiative recombination rate calculated with observed electron temperature and number density to the luminosity of the flow. The results of integrating the electron energy equation including the effect of recombination energy transfer was compared to the data to show that the fraction of ionization energy given to the electron gas was not constant through the shock. Author (TAB)

N70-10482# University Coll., Cork (Ireland). Dept. of Electrical Engineering.
MICROWAVE STUDIES OF IONIZATION PHENOMENA IN GASEOUS DISCHARGES Final Scientific Report, 1 Jan. 1967 - 28 Feb. 1969
Michael C. Sexton 1 Apr. 1969 11 p
(Grants AF-EOAR-67-32)
(AD-691905; AFOSR-69-2005TR) Avail: CFSTI CSCL 20/9

Microwave and spectroscopic analyses of high density pulsed afterglows in argon, helium and hydrogen have been carried out. Results in the rare gases supported the theoretical prediction of collisional radiative recombination as a major electron removal process especially at high densities, and were particularly interesting in argon as little detailed information was previously available in this gas. The atomic to molecular ion conversion mechanism was also studied in argon. The possibility of negative ion formation in hydrogen was examined at low pressures, whereas at pressures above 1 torr the existence of complex molecular hydrogen ions was inferred. The locations of the Tonks-Dattner resonances in current-modulated cylindrical plasmas (positive columns) using microwave absorption were shown to depend on whether the increasing or decreasing half-cycle was under observation. A similar effect was noted when the more fundamental parameter, electron density, measured with a microwave cavity, was used to monitor the resonant spectra. Author (TAB)

N70-10581# Plasma Sciences Labs., Inc. Van Nuys, Calif.
A SPECTRAL DIAGNOSTIC METHOD FOR DETERMINING INTERNAL PROPERTIES OF ASYMMETRICAL PLASMAS Final Report
H. N. Olsen, F. L. Kelly, and L. L. Price Wright-Patterson AFB, Ohio ARL Apr. 1969 124 p refs
(Contract F33615-67-C-1071)
(AD-692511; ARL-69-0061) Avail: CFSTI CSCL 20/9

A numerical method has been developed for inverting the integral equation which relates the emitted spectral intensity to the internal emission coefficient for optically thin plasmas. The method is applicable to both symmetrical and asymmetrical plasmas with no prerequisite orientation of the source with respect to the laboratory coordinate system. The validity of the series representation of the emission coefficient has been checked by means of a hypothetical model consisting of a source whose emission coefficient is taken as a displaced symmetrical gaussian function. The method has been further tested by applying it to a symmetrical experimental argon arc which has been displaced with respect to the coordinate system to simulate an asymmetrical plasma. The fully developed method has been used as a practical diagnostic tool to investigate the internal properties of a generally asymmetrical experimental plasma produced by interacting the free-burning argon arc with an external magnetic field. Initial steps have been taken to develop a practical method for diagnosing optically thick plasmas without requiring any direct measurements of the transmission along the path of integration by means of reflection optics or an external source of radiation. Author (TAB)

N70-10648# Joint Publications Research Service, Washington, D.C.
THEORY OF WAVE FLUCTUATIONS AND SCATTERING IN A PLASMA IN STRONG ELECTRIC AND MAGNETIC FIELDS
I. A. Akhiyezer et al *In its* Scientists Investigate Wave Motion Probl. 25 Aug. 1969 p 15-24 refs Transl. into ENGLISH from Zh. Eksperim. Teor. Fiz. (Moscow), v. 55, no. 6 (12), 1968 p 2291-2297 (See N70-10645 01-13)
Avail: CFSTI

Fluctuations and scattering of electromagnetic waves in a partially ionized plasma in strong magnetic and electric fields are studied. It is demonstrated that in the case of a strong magnetic field the fluctuation correlators have sharp maxima at the frequencies of magnetosonic oscillations. When the external electric field approaches a critical value, the intensity of the fluctuations increases. For propagation of an electromagnetic wave in a plasma in the scattered radiation spectrum sharp maxima occur removed from the basic line by the frequency of the magnetosonic wave (magnetosonic satellites). Author

N70-10701# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. für Physik der Atmosphäre.
NUCLIDE COMPOSITION AND BETA DECAY CURVES OF FRACTIONATED FISSION PRODUCT MIXTURES FOR DIFFERENT FISSION CASES [NUKLIDZUSAMMEN SETZUNG UND BETA ZERFALLSKURVEN FRAKTIONIERTER SPALTPRODUKTGEMISCHE FUER VERSCHIEDENE SPALTFAELLE]
W. Peters and D. Paffrath Jun. 1969 96 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-39; DVL-878) Avail: CFSTI

The shape of β-decay curves of fission product mixtures depends upon nuclide composition and therefore on the fractionation of the nuclides in the sample. The nuclide composition and corresponding β-decay curves of variably fractionated fission product mixtures are calculated for five different fission cases. The results are represented by tables and graphs. Considering absorption and scattering of β-particles, conversion electrons, and artificial fractionation the modified theoretical β-decay curves adapted to the experimental conditions are constructed. Using these decay curves it is possible to analyse measured β-disintegration curves. Author (ESRO)

N70-10730*# California Univ., Berkeley. Space Sciences Lab.
FINITE-LARMOR-RADIUS ANALYSIS OF LAMINAR COLLISIONLESS SHOCKS
Ferdinand Vincent Coroniti (Ph.D. Thesis) Jul. 1969 205 p refs *Its* Ser. 10, Issue 36
(Grant NGL-05-003-012)
(NASA-CR-106657) Avail: CFSTI CSCL 20I

The structure of finite-beta laminar collisionless fast and slow shock waves is investigated from the finite-Larmor-radius Chew - Goldberger - Low (FLR-CGL) hydromagnetic fluid equations. As a motivation for the shock study the linear dispersion relation for the three hydromagnetic waves is derived including ion FLR dispersion. To calculate the shock structure two criteria must be satisfied: (1) a complete set of Rankine - Hugoniot conservation laws must exist; (2) the moment hierarchy of the Vlasov equation must be truncated. Two approximations which close the Rankine - Hugoniot relations are considered: (1) for near-perpendicular fast shocks the parallel temperature is taken to be approximately constant; (2) for arbitrary propagation angle the parallel and perpendicular components of the pressure tensor are taken to be equal. With these approximations a wave train differential equation for the magnetic field is derived in the weak shock approximation. A linearized analysis about the Rankine - Hugoniot stationary points is then performed to determine the wave train properties. Author

N70-10742# Institut National des Sciences et Techniques Nucleaires, Saclay (France).
A PHENOMENON OF DIRECT CONVERSION OF IONIZING ENERGY RESULTING FROM THE FORMATION OF NEGATIVE DROPLETS BY ELECTRON CAPTURE DURING CONDENSATION OF A VAPOUR EVEN WITHOUT ELECTRONIC AFFINITY [SUR UN PHENOMENE DE CONVERSION DIRECTE D'ENERGIE IONISANTE RESULTANT DE LA FORMATION DE GOUTTELETTES NEGATIVES, PAR CAPTURE D'ELECTRONS, LORS DE LA CONDENSATION D'UNE VAPEUR, MEME SANS AFFINITE ELECTRONIQUE]

Pierre Kraus (Ph.D. Thesis–Paris Univ., 26 Jun. 1969) CEA Aug. 1969 134 p refs In FRENCH; ENGLISH summary
(CEA-R-3873) Avail: CFSTI

An electromotive force was produced between a hot and cold electrode immersed in an ionized vapour. It is shown that the asymmetry thus created was due to the formation of heavy negative charge carriers following the condensation of the vapour in the volume close to the cold electrode. The electromotive forces produced are explained on the basis of a decrease in the floating potential of the cold electrode. Author (ESRO)

N70-10846# Nihon Univ., Tokyo (Japan).
PLASMA PHYSICS
Masahiro Yokota, Hisamitsu Yoshimura, Shigeo Hamada, Haruyuki Ohnishi, Kazuo Sato et al *In its* Plasma, Solid State, and Theoret. Phys. 1968 p 3–34 refs (See N70-10845 01-24)
Avail: CFSTI

A general conclusion concerning the drift motion and stabilization of plasma was obtained. Experiments on the confinement of a plasma produced by slow theta pinch continued; it was confirmed that the direction of the drift motion is determined by the local field configuration and the stabilization which comes from the mirror end. Development of plasma diagnostics continued. The experimental axial distribution of energy density in the collision of two plasma streams was compared with theoretical values. Waves in a direct-current discharge plasma were studied by a newly developed multiparameter analyzer. Theoretical work on nonlinear phenomena in plasmas was finished, with emphasis on the problem of plasma wave echoes. Various possible mechanisms of the hard X-ray in low theta-pinch observed were also investigated. G.G.

N70-10985# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ONE PROBLEM OF A THREE-DIMENSIONAL BOUNDARY LAYER IN MAGNETOHYDRODYNAMICS
E. V. Shcherbinin 29 Nov. 1968 9 p refs Transl. into ENGLISH from Magnitn. Gidrodinamika (Russia), no. 4, 1967 p 76–79
(AD-692046; FTD-HT-23-978-68) Avail: CFSTI CSCL 20/9

The problem is solved of the interaction of two boundary layers of a conducting fluid, one of which is a two-dimensional laminar jet boundary layer, and the other which is a near-wall boundary layer. The effect of the velocity profile bulging near an insulated solid surface is observed, if the magnetic field has been oriented along the surface orthogonally with respect to the wake. Author (TAB)

N70-11056# Academy of Sciences (USSR), Leningrad. Physicotechnical Inst.
LINEAR TRANSFORMATION OF WAVES IN AN INHOMOGENEOUS MAGNETOACTIVE PLASMA
A. D. Piliya and V. I. Fedorov 1968 20 p refs In RUSSIAN
(FTI-144) Avail: AEC Depository Libraries

The electric field of a wave, being propagated in a cold plasma, whose concentration depends on a single coordinate x, has a peculiarity at the point where the tensor component of the dielectric penetrability goes to zero. The presence of this peculiarity leads to energy absorption of the wave, which does not disappear even in the absence of collisions. In this study the problem is solved for a moderately heated plasma, that is, with weak spatial dispersion being taken into account in order to estimate the practical possibilities of heating a plasma. It is shown that spatial dispersion leads to a situation where in place of energy absorption there takes place a transformation of the incident wave into a slow plasma wave. The energy carried by the plasma wave is equal to the energy absorbed in the cold plasma. The conditions under which the spatial dispersion can be considered as weak do not place any substantial limitations on plasma temperature in cases of practical interest. However, this approximation is not applicable at frequencies close to the cyclotron frequency or to the frequency of the second harmonic. NSA

N70-11152# Academy of Sciences (USSR), Leningrad. Physicotechnical Inst.
ABSORPTION OF ELECTROMAGNETIC WAVES IN A STRONGLY INHOMOGENEOUS PLASMA
A. D. Piliya and V. I. Fedorov 1968 17 p refs In RUSSIAN
(FTI-104) Avail: AEC Depository Libraries

A layer of cold, collisionless plasma with concentration depending on one coordinate x in a homogeneous external magnetic field is considered for solution. The wave vector is perpendicular to the concentration gradient. The magnetic field is at an arbitrary angle to the concentration gradient. The wave equation is written, and dimensionless terms are introduced. The set of equations are solved in explicit form for small layer thicknesses by replacement by an equivalent integral equation and solving by successive approximations. The power adsorbed by unit surface of the layer is then determined in the region of frequencies where strong absorption is to be expected. An expression is also obtained for maximum absorption. NSA

N70-11213# Texas Univ., Austin. Electronics Research Center.
COLLISIONAL DRIFT LIKE INSTABILITY OF A WEAKLY IONIZED MAGNETOPLASMA WITH NO AXIAL DRIFT
Peter B. Mumola and Edward J. Powers May 1969 67 p refs
(Contract AF-AFOSR-67-766E; NSF GK-845)
(AD-692193; AFOSR-69-1145TR; TR-64) Avail: CFSTI CSCL 20/9

The results of a theoretical and experimental study of the stability of inhomogeneous weakly ionized magnetoplasmas with no anial drift are reported. A linearized two-fluid hydrodynamic stability analysis yields a dispersion relation which is analyzed numerically. Oscillations with an azimuthal phase velocity approximately equal in magnitude and in the same direction as the electron diamagnetic drift are predicted to become unstable (onset) once the external magnetic field exceeds some critical value. This instability has been observed experimentally in a capacitively coupled radio-frequency discharge immersed in a static, uniform magnetic field. The RF discharge was utilized in order to simulate a plasma with no applied axial drift of particles. Stability criteria are displayed graphically in terms of the magnetic field strength, neutral gas pressure, and discharge tube radius. Experimental measurements are found to be in excellent agreement with the predicted values of critical magnetic field and phase velocity over a wide range of neutral gass pressures and several different discharge tube radii. The parametric dependence (on pressure and magnetic field) of both the theoretically predicted and experimentally measured phase velocity is similar to that expected for a drift wave. For this reason the instability is referred to as a drift instability. Author (TAB)

N70-11247*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
PIONEER 6 PLASMA MEASUREMENTS IN MAGNETOSHEATH
Herbert C. Howe, Jr. Jun. 1969 29 p refs
(Grant NGR-22-009-372)
(NASA-CR-106735; CSR-P-16) Avail: CFSTI CSCL 20I

Measurements of the magnetosheath plasma made during the outbound passage of Pioneer 6 in the dusk meridian are presented and compared with theoretical predictions for the same region. While the comparison indicates that the plasma flow around the earth agrees in many ways with a gas dynamic model, observed discrepancies in the density ratio across the bow shock

and the non-Maxwellian velocity distribution in the magnetosheath warrant further explanation. Magnetosphere and magnetosheath low energy electron measurements indicate a region of anisotropic flux in the magnetosphere near the magnetopause. Author

N70-11276# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Stuttgart (West Germany). Inst. für Energiewandlung und Elektrische Antriebe.
COLLISION DOMINATED SHEATH IN WEAKLY IONIZED PLASMAS, PART 1 [STOSSBESTIMMTE GRENZSCHICHT IN EINEM SCHWACHIONISIERTEN PLASMA, TEIL 1]
P. Wahle and K. G. Müller (Bonn Univ.) Feb. 1969 92 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-08; DVL-807) Avail: CFSTI

The sheath investigated here represents the transition between a collision dominated plasma and a wall. In approaching the wall the velocity distribution functions of the charge carriers become more and more anisotropic, the density and the temperature of the charge carriers and the electric field become more and more inhomogeneous and the space charge increases. The situation at the wall can be described correctly only by a restriction of the velocity distribution. The sheath models developed until now are approximations of this exact description. This implies a limitation of their validity but in a parameter diagram the region of validity can be defined. There is a gap between the models 'continuum case' and 'dense case'. In the second part of this paper a new model will be developed, which contains these two models as extreme cases. Author (ESRO)

N70-11344*# Utah Univ., Salt Lake City. Dept. of Electrical Engineering.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF SOLID-STATE MECHANISMS FOR GENERATING COHERENT RADIATION IN THE ULTRAVIOLET AND X-RAY REGIONS Semiannual Report, 1 May – 31 Oct. 1968
A. Silzars, C. H. Durney, and R. W. Grow 15 Feb. 1969 210 p refs
(Grant NGR-45-003-027)
(NASA-CR-105274; UTEC-MD-69-019; SAR-5) Avail: CFSTI CSCL 20I

The double-stream interaction in a solid-state plasma is analyzed for a layered structure where the two charge-carrying streams are in adjacent layers, with the stream in one layer assumed to be stationary. The theory has been developed assuming that no external magnetic field is applied. Analysis of the idealized one-dimensional model with a single drift velocity for all carriers predicts high gain for a frequency of 1 GHz to 10 mu m in wavelength, for commercially available semiconductors. The effects of finite temperature, particle collisions, and transverse ac velocities change the results of the idealized model drastically. The velocity spread introduced by the randomizing effects of temperature reduces the gain below useful levels for temperatures above about 35 K in germanium. This limits operation of practical devices to very low temperatures. Particle collisions add severe damping at frequencies below about 300 GHz in most semiconductors, e.g., germanium and indium antimonide. Author

N70-11345# General Electric Co., Philadelphia, Pa. Space Sciences Lab.
MEASUREMENT OF THE ELECTRICAL CONDUCTIVITY OF XENON IN A SHOCK TUBE
B. Zauderer Jul. 1969 14 p refs
(Contract Nonr-3867(00))
(AD-691254; Rept-69SD7; ONR-TR-13) Avail: CFSTI CSCL 20/9

The electrical conductivity of xenon was measured in a shock tube at gas pressures of about one atmosphere and in the temperature range of 5500K to 9000K. Where ionization equilibrium was achieved immediately behind the shock front, the experimental conductivities were in agreement with the theoretical analyses based on either the Boltzman equation or the Fokker-Plank equation. At Mach numbers below 8 ionization equilibrium was not always achieved and considerable uncertainty exists in correlating the measured conductivity to known gas properties. Author (TAB)

N70-11393# Physics International Co., San Leandro, Calif.
DYNAMIC EFFECTS OF HIGH NU/GAMMA BEAM PLASMA INTERACTIONS Interim Report, 1 Nov. 1968 – 15 Mar. 1969
Gerold Yonas, Philip Spence, Don Pellinen, Bruce Ecker, and Sergei Heurlin Apr. 1969 73 p refs
(Contract DASA01-68-C-0096)
(AD-692465; PITR-106-1; DASA-2296) Avail: CFSTI CSCL 20/7

Time and spatial definition of high nu/gamma beam generation and propagation has been investigated using calorimetry, voltage and current diagnostics and time of flight measurements. This work demonstrates that the main portion of these beams, in 0.5 to 1.0 torr air, propagates with a value of (nu/gamma) net which is approximately 1.0 and roughly equal values of energy in the longitudinal and transverse components of motion. The beam front propagates at velocities considerably slower than the main portion of the beam and work done by the induced electric field, due to the initial current rise, contributes to energy loss. Time-dependent measurements of net and primary current have been correlated with a diffusion dominated model of current neutralization, the key parameters in this model being the risetime of the primary current, the avalanche breakdown time of the gas, and the plasma conductivity after breakdown. Beam manipulation experiments, such as shaping, splitting and recombination, and attempts to form an electron ring are also reported. Author (TAB)

N70-11397*# Stanford Univ., Calif. Inst. for Plasma Research.
HIGH-FREQUENCY BEAM-PLASMA INTERACTION AT FINITE TEMPERATURES
M. Seidl Jun. 1969 53 p refs
(Grant NGR-05-020-077; Contract AT(04-3)-326)
(NASA-CR-106730; SU-IPR-327) Avail: CFSTI CSCL 20I

The dispersion equation corresponding to the interaction of an electron beam with a Maxwellian plasma has been solved in quasi-static and infinite geometry approximations. Two representative beams are considered: a parallel beam with isotropic velocity spread and a helical beam with different longitudinal and transverse temperatures. The aim of the work is to present an experimenter's guide to predict the frequency, growth rate, and wave numbers of the most unstable waves as functions of the basic beam and plasma parameters. The results of the calculations are presented in graphs suitable for comparison with the experiments. The effect of plasma and beam temperatures on the spectrum of the instabilities is discussed in detail. It is shown that the plasma temperature reduces the growth rate of the instabilities of cyclotron harmonic frequencies while a velocity spread in the helical beam suppresses the instabilities everywhere, except in the vicinity of the cyclotron harmonics. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N70-10111 Virginia Univ., Charlottesville.
THE EFFECT OF MAGNETOSTRICTION ON THE LONGITUDINAL MAGNETORESISTANCE OF IRON SINGLE CRYSTALS
Paul William Shumate, Jr. (Ph.D. Thesis) 1968 110 p

Avail: Univ. Microfilms: $5.40/Microfilm $3.00 Order No. 68-18223

The longitudinal magnetoresistance of iron at 4.2 K has an anomalous negative behavior in the region below 1 kOe which was attributed to such phenomena as domain wall scattering, transverse magnetoresistance resulting from a net transverse component of the random orientation of the internal magnetization, and transverse magnetoresistance resulting from magnetization in a circular configuration everywhere parallel to the self-field of the longitudinal measuring current. The longitudinal magnetoresistance of iron single crystals of <100> and <111> axial orientation was measured simultaneously with the application of longitudinal stresses up to 45 kg/sq mm. The effects on the magnetoresistance are interpreted in terms of the effect of the stress upon the internal magnetization through inverse magnetostriction. A dynamic model for the <100> crystal is developed, and the experimental results are shown to be predictable from the theoretical model. The transition from the low-field resistance to the high field resistance is seen to take place at a critical stress, or the reverse transition at a critical current. Dissert. Abstr.

N70-10187# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.

CONDUCTION PROCESSES IN FERROMAGNETIC ALLOYS Final Report, Jan. 1966 - Dec. 1968

Luc Berger Mar. 1969 44 p refs

(Contract DA-ARO-D-31-124-G785)

(AD-691898; FR-1; AROD-61) Avail: CFSTI CSCL 20/12

Contents: Magnetoresistance of permalloy single crystals; Galvanomagnetic effects, magnetostriction and spin-orbit interaction in Cu-Ni-Fe and other ferromagnetic nickel alloys; Hall effect and asymmetric scattering in iron at low temperature; and Thermal conductivity of ferromagnetic alloys in a magnetic field. TAB

N70-10228# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INTERNAL FRICTION IN METALS Selected Articles

31 Jan. 1969 31 p refs Transl. into ENGLISH from Vnutr. Trenie Metal. Splavakh, Akad. Nauk SSSR, Inst. Met. (Moscow), 1966 p 42-45, 157-163, and 216-221

(AD-692187; FTD-HT-23-784-68) Avail: CFSTI CSCL 20/12

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2. SOME METHODS FOR STUDYING AMPLITUDE-DEPENDENT DISSIPATION OF ENERGY IN A MATERIAL A. P. Yakovlev p 7-16 (See N70-10230 01-32)

3. TOWARD THE THEORY OF THERMOELASTIC INTERNAL FRICTION IN A SOLID BODY Ya. S. Podstrigach et al p 17-25 refs (See N70-10231 01-32)

N70-10229# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF IMPERFECTIONS OF CRYSTAL STRUCTURE ON ELASTIC AND INELASTIC PROPERTIES OF ALUMINUM

T. Ya. Beniyeva et al *In its* Internal Friction in Metals 31 Jan. 1969 p 1-6 refs (See N70-10228 01-26)

Avail: CFSTI

The effect of temperature on Young's modulus (E) and vibration decrement (delta) in Al (99.99%) single and polycrystals and varying degrees of perfection were studied. The axis of single crystal test cylinders was in the (110) direction. All specimens were annealed at 600 deg before testing. The resonance method was used for the determination of E and delta. With increasing temperature the E of single crystals decreases gradually but nonlinearly, the decrease being faster as the temperature is increased. The E vs. temperature curves coincide up to 300 deg for single crystals, polycrystals, and recrystalized crystals. Above 300 deg, E decreases more rapidly and the more so the less perfect the crystal. The E at higher temperatures depends, therefore, on the structure. Author

N70-10318# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

REVIEW OF THE CRYOGENICS SESSION SECOND WEEK OF THE BROOKHAVEN SUMMER STUDY ON SUPERCONDUCTING DEVICES AND ACCELERATORS

T. R. Strobridge Repr. from Proc. of the 1968 Summer Study on Superconducting Devices and Accelerators, Pt. 1, 1968 p 388-375 refs

(PB-184221; R-512) Avail: CFSTI CSCL 20L

The paper consists of reviews of the lecture topics on cryogenics, which were: the low temperature mechanical properties of metallic structural materials, properties of metallic structural materials, properties of nonmetallic materials at cryogenic temperatures, cryostat design, cryopumping, cryogenic electrical leads, cryogenic safety, superfluid helium as a refrigerant, heat transfer to helium I, refrigeration, the European state of the art, and refrigeration for superconducting magnets in the 200 GeV accelerator, Weston, Illinois. USGRDR

N70-10323# State Inst. for Technical Research, Helsinki (Finland).

ETCH PIT OBSERVATIONS IN TRIGONAL SELENIUM SINGLE CRYSTALS

J. Heleskivi, O. Pilvioe, and T. Stubb Swedish Acad. of Eng. Sci. in Finland, Helsingfors, Finland *Its* Phys. including Nucleonics Series No. 62 1968 16 p refs

(PB-184606; APS-PH-62) Avail: CFSTI CSCL 20B

The (10 (-1)0) and (0001) planes of trigonal selenium singly crystals grown from the melt were studied by optical microscopy after chemical etching. The results are compared with the barrier model presented to explain the electrical properties of selenium. On the (10 (-1)0) planes, small angle boundaries produced during crystal growth, have been observed. On the surface of a heavily worked crystal completely polygonized structure has been observed. The size of the polygons is well consistent with the distance between potential barriers estimated by electrical methods. Author (USGRDR)

N70-10484# State Univ. of New York at Buffalo. Dept. of Physics.

ATOM-ENVIRONMENT THEORETICAL STUDY Final Report

Henry Goldberg 30 Oct. 1968 4 p

(Grant AF-AFOSR-896-65)

(AD-692536; AFOSR-68-1981) Avail: CFSTI CSCL 20/12

The symmetry effects on atoms in solids have been investigated extensively. Most of the earlier approaches assumed that the symmetry effects can be thought of as arising from point charges, distributed in the solid in a regular fashion. However, the point charge approach is basically incorrect, as one knows that electrons are not localized, but rather, that there is a finite probability of finding them anywhere in the solid. Also, electrons are indistinguishable from one another, which is implied in the statement of the famous Pauli Exclusion Principle. The present approach investigates symmetry effects on atoms in the solids, taking into account the fact that electrons are not localizable as points charges, and that they are indistinguishable. As a result of this approach, it was found that under certain circumstances, atoms may possess some additional energy levels which cannot be predicted by previous theories. This points to the experimental investigation of these effects and a confirmation of these would be encouraging for the present theoretical approach. These new energy levels predicted, if found experimentally, would increase greatly the number of materials which would lase, which could be a help in communication problems and others, as well. Author (TAB)

N70-10558# Technische Hogeschool, Eindhoven (Netherlands).
ELECTRICAL TRANSPORT PHENOMENA IN MnTe, AN ANTIFERROMAGNETIC SEMICONDUCTOR
Jan Douwe Wasscher (Ph.D. Thesis) 1969 94 p refs Submitted for publication
Avail: CFSTI

The electrical properties of MnTe, which is a non-oxidic antiferromagnetic semiconductor, are investigated. A temperature-dependent anisotropy is found in the resistivity, which indicates that this anisotropy is in either the effective mass or the relaxation time for scattering. Proposals are made for extensions of Haas's theory of spin-disorder scattering, on the basis of discrepancies found in comparing the experimental data with the theory. Considerations involving second-order drag effects indicate that the effective mass and the acceptor-level depth may change with temperature near T sub n (in accordance with one of the proposed modifications of the theory). It is concluded that a magnetization dependence of the band parameters contributes significantly to the observed behavior of the electrical transport properties of MnTe. R.B.

N70-10571# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE PRECESSION METHOD IN METALLURGICAL TWIN STUDIES
Priscilla W. Kingman Jul. 1969 47 p refs
(AD-692308; BRL-1441) Avail: CFSTI CSCL 20/2

The principles of detecting and characterizing twins by X-ray diffraction techniques are discussed with particular reference to the precession method. The analogy between twin determination and space group determination is stressed. Specific examples are presented for the particular case of face-centered cubic deformation twins. Author (TAB)

N70-10653# Technische Hochschule Munchen (West Germany). Fakultat fuer Allgemeine Wissenschaften.
REVERSIBILITY RULE FOR BACK SCATTERING OF PROTONS ON COPPER SINGLE CRYSTALS [DIE REVERSIBILITATSREGEL BEI DER RUECKSTREUUNG VON PROTONEN AN KUPFEREINKRISTALLEN]
Bernhard M. U. Scherzer (Ph.D. Thesis) 1969 38 p refs In GERMAN
Avail: CFSTI

Application of the reversibility rule on anisotropic Rutherford backscattering of 60 and 120 KeV protons from single copper crystals was studied at differing temperature levels. Also measured were angle and energy distribution of backscattered hydrogen atoms during impact and at small angles against the <110> direction with silicon surface barrier layer counters. Minimal backscatter diagrams of equal line intensities were formed for the various depths of backscattered hydrogen atoms. Backscatter minima caused by lattice direction and shadow effects corresponded best in all details when backscatter took place close to the surface at high primary energies and low temperatures. Deviation patterns at greater depths were attributed to proton energy losses during lattice transition. Backscatter minima determined the half width of lattice direction and shadow effects; they were markedly effected by induced radiation damage. Transl. by G.G.

N70-10655# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
INJECTION AND RECOMBINATION MECHANISMS IN GaAs P-N JUNCTIONS WITH HIGHLY DOPED, COMPENSATED P ZONE [INJEKTIONS- UND REKOMBINATIONSMECHANISMEN IN GaAs-PN-UBERGAENGEN MIT HOCHDOTIERTER KOMPENSIERTER P-ZONE]
Karl-Heinz Zschauer (Ph.D. Thesis) 1968 92 p refs In GERMAN
Avail: CFSTI

Injection luminescence of gallium arsenide p-n junctions is studied by evaluating spectral distribution of recombinative radiation and absorption in connection with band structure distortions at medium and high doping levels. Behavior variations in n- and p-GaAs are attributed to large differences in effective electron and hole masses; p-n structures with a highly doped compensating p-zone possessed intensive electron injection luminescence. Recrystallization of GaAs from a tin-zinc melt produced highly compensating doped p-layers with a recombinative photon energy radiation of about 0.15 eV below the value of the energy gap. Analysis of temperature and voltage effects on energy flow and integral light intensity developed that the injection barrier was determined by a p-type intermediate layer that formed during recrystallization by the diffusion of zinc. Effective quanta were determined by nonradiative recombination during lattice transition caused by the differential lattice constants of substrate and recrystallization layer. Transl. by G.G.

N70-10778# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
EFFECT OF DIAMAGNETIC YTTRIUM DILUENTS IN MAGNETICALLY ORDERED ErAl SUB 2 ON THE VALUES AFFECTING THE MOESSBAUER SPECTRUM [EINFLUB VON DIAMAGNETISCHEN YTTRIUM VERDUNNUNGEN IN MAGNETISCH GEORDNETEM ErAl SUB 2 AUF DIE DAS MOBBAUER-SPEKTRUM BEEINFLUSSENDEN GROBEN]
Hans-Juergen Jaeckel (Ph.D. Thesis) 1969 51 p refs In GERMAN
Avail: CFSTI

Mossbauer experiments on erbium 166 in intermetallic compounds ErAl3 and ErAl2 established absorption spectra with line broadening below the magnetic ordering temperature. These distortions were caused by shell spin fluctuations with relaxation times of similar values as the Lamor precession times of nucleus spin in the internal magnetic field. The effects of magnetic dilutions on relaxation time in the ErAl2 lattice were studied by substituting the paramagnetic Er(3+) ions with diamagnetic Y(3+) ions. Spectrum analyses showed that electronic ground levels of erbium ions depended on neighboring configurations; possible neighboring configurations determined the number, relative frequency, and intensity of the single spectrum. The observed temperature dependence of the quadrupole separation was determined by exchange field effects. Transl. by G.G.

N70-10800# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
ON THE SOLID STATE CHARACTERISTICS OF COMPOUNDS WITH UNPAIRED ELECTRONS [UEBER DIE FESTKOERPEREIGENSCHAFTEN VON VERBINDUNGEN MIT UNGEPAARTEN ELEKTRONEN]
Dietrich Noethe (Ph.D. Thesis) 1969 68 p refs In GERMAN
Avail: CFSTI

The strength of intermolecular covalent bonds between various planar radicals resp. coplanar donor-acceptor systems was studied. Emphasis was placed on paramagnetic transition metal complexes or organic radical model substances. A detailed charge transfer model was used to predict desired properties. Spectroscopic absorption spectra, electrical conductivity, and magnetic analyses were applied to validate the model and to prove strong electron coupling in the lattice of the organic radical triphenylmethyl. The predicted dependence of the electrical resistance was proven from energy densities of higher bands in planar platinum complexes. Transl. by G.G.

N70-10847# Nihon Univ., Tokyo (Japan).
SOLID STATE PHYSICS
Ko Yasukochi, Kazuko Sekizawa, Takeshi Ogasawara, Nobumitsu Usui, Motoyoshi Ishizuka et al *In its* Plasma, Solid State, and Theoret. Phys. 1968 p 35–46 refs (See N70-10845 01-24)
Avail: CFSTI

Magnetic properties of superconducting niobium tantalum and vanadium were determined and the results compared with microscopic theory. The resistive behavior of the mixed state in vanadium was studied for the motion of quantized flux lines. Helicon-like oscillations in superconducting tin and the effects of paramagnetic impurities on the superconducting properties of lanthanum alloy were also investigated. Basic research in superconducting magnets centered on low field instability in high field superconducting wire. A superconducting magnet constructed with niobium-titanium wire was operated in a very stable mode with no flux jump and attained 80 KG. The compound NbN made by reactive sputtering method was found to have the upper critical field of 200 KG by means of pulsive magnetic field. G.G.

N70-11099# Texas Instruments, Inc., Dallas.
INVESTIGATION OF RADIATION EFFECTS IN SEMICONDUCTORS
James G. Aiken, Martin G. Buehler, James S. Crabbe, and Walter T. Matzen 1 Mar. 1969 40 p refs
(Contract F19628-68-C-0184)
(AD-692517; TI-03-69-21 SR-4; AFCRL-69-0164) Avail: CFSTI CSCL 9/1

Resistivity and lifetime measurements have been taken on neutron-irradiated n-type silicon having impurity concentrations ranging from 10 to the 14th power to 10 to the 18th power/cubic cm. The values, as obtained by various techniques, basically follow expected trends. However, the measurement method becomes significant as the concentration of neutron-introduced defects becomes comparable with the original donor concentration. A second test bar for the purpose of modeling bipolar h sub FE degradation has been characterized after neutron irradiation. Pre- and post-irradiation data on the test bars indicate that the neutron-induced component of base current is predominantly in the bulk for a wide range of profiles under investigation. The base-surface concentrations ranged from 1 X 10 to the 18th power/cubic cm to greater than 10 to the 20th power/cubic cm and the base widths from less than 1 line to 14 lines. The bulk current is being related to terminal small-signal device characteristics. Author (TAB)

N70-11249# Hughes Research Labs., Malibu, Calif.
CONDENSATION AND NUCLEATION PROCESSES OF SINGLE CRYSTAL THIN FILMS Final Report, 15 Oct. 1967–30 Apr. 1969
Morris Braunstein and Ryoichi Kickuchi Jun. 1969 108 p refs
(Contract F33615-68-C-1089)
(AD-691279; AFML-TR-69-149) Avail: CFSTI CSCL 20/2

The purpose of this contract was to investigate the path probability technique for calculating rates of nucleation, to develop experimental techniques for growing thin films on amorphous substrates, and to make electrical measurements and electron microscopic examinations of the thin films. In the theoretical program, the path probability method was used to study the film growth process. In the experimental program a moving mask technique was used for film growth; this technique attempts film growth by starting with a few nuclei and suppressing further nucleation. Author (TAB)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N70-10477# Air Force Systems Command, Wright-Patterson AFB, Ohio. Aero Propulsion Lab.
DIAGNOSTICS OF LOW-SPECIFIC-CHARGE COLLOID ION BEAM Technical Report, Jun. 1967–Jun. 1969
Jack W. Geis Jun. 1969 89 p refs
(AD-692101; AFAPL-TR-69-13) Avail: CFSTI CSCL 21/3

As part of an in-house colloid diagnostic program, the first detailed mapping of propellant mass flow distribution from a colloid source was completed, and the program has shown the influence of anisotropic or non-uniform flow conditions within the beam on the efficiency of source operation. The operating conditions of high propellant feed pressure, low voltage, and high resistivity of the sodium iodide/glycerol propellant, which created a very low specific charge beam, caused a nonuniform distribution of specific charge and beam current as function of beam divergence half angle. The assumption of uniform beam conditions would result in a 12% error in computing thrust and a 25% error in determining overall efficiency. Author (TAB)

N70-11011# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strahlantriebe.
THEORETICAL THERMODYNAMIC DATA AND CALCULATIONS OF PERFORMANCE OF THE ROCKET PROPELLANT SYSTEM H2/O2 FOR A CHAMBER PRESSURE OF 0.484 KP/SQ CM [THEORETISCHE THERMODYNAMISCHE DATEN UND LEISTUNGSBERECHNUNGEN DER RAKETENTREIBSTOFFKOMBINATION H2/O2 FUER EINEN BRENNKAMMERDRUCK VON 0,484 KP/SQ CM]
Winfried Buschulte and Helmut Koch Mar. 1969 29 p refs
In GERMAN; ENGLISH summary
(DLR-MITT-69-05) Avail: CFSTI

For the rocket propellant system H2/O2 with a chamber pressure of 0.484 kp/sq cm the main theoretical thermodynamic values, the characteristic rocket propulsion figures and the vacuum specific impulse have been computed and are shown in diagrams and tables depending on the mixture ratio and the expansion ratio. Author (ESRO)

N70-11130*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
POLYMERIZATION METHOD Patent Application
Joseph A. Miller, Jr., inventor (to NASA) Filed 28 Jul. 1969 11 p
(Contract NAS7-100)
(NASA-Case-NPO-10893; US-Patent-Appl-SN-845584) Avail: CFSTI CSCL 21/1

The method comprises contacting isobutylene with a molecular sieve to achieve the polymerization. The reaction is carried out in the liquid phase by condensing isobutylene into a vessel containing the molecular sieve. The reaction can be carried out at ambient temperature and autogenous pressure for varying periods of time. As the reaction period increases, or temperature is lowered, the molecular weight of the resulting polyisobutylene and polymerization efficiency tend to increase. Additionally, if the material is stirred during the reaction period the molecular weight will tend to increase. At completion of the reaction period, the formed product is removed from the molecular sieve by a suitable hydrocarbon solvent and then separated from the solvent. It was found that the results are particularly obtainable through the utilization of a 5-Angstrom molecular sieve. NASA

N70-11376# Wissenschaftliche Gesellschaft für Luft- und Raumfahrt, Cologne (West Germany).
PROCEEDINGS OF THE SIXTH WGLR MEETING ON PROPELLANTS [BERICHT UEBER DIE 6. SITZUNG DES WGLR-FACHAUSSCHUSSES TREIBSTOFFE]
Oct. 1968 94 p refs In GERMAN; ENGLISH summary Conf. held at Stuttgart, 27 Jun. 1966
(DLR-MITT-68-13) Avail: CFSTI

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8. TRANSPORTATION AND ISOLATION PROBLEMS IN THE USE OF HIGH ENERGY PROPELLANT COMBINATIONS O2/H2 H. Bending (Entwicklungsring Nord) p 75–87 (See N70-11383 01-27)

9. STORABLE HIGH ENERGY PROPELLANT COMBINATIONS E. W. Schmidt (DVL, Stuttgart) p 88–95 (See N70-11384 01-27)

N70-11377# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Stuttgart (West Germany).
THRUST AUGMENTATION BY MEANS OF HIGH ENERGY ROCKET PROPELLANTS [LEISTUNGSSTEIGERUNGEN DURCH EINSATZ HOCHENERGETISCHER RAKETENTREIBSTOFFE]
A. Dadieu *In* WGLR Proc. of the 6th WGLR Meeting on Propellants Oct. 1968 p 7–21 refs In GERMAN (See N70-11376 01-27)
Avail: CFSTI

Several propellant compositions may be used to increase the specific thrust of upper stage rockets. Such increases may be obtained by oxidizers (oxygen, ozone, fluorine, fluorine oxide), or by adding lithium or beryllium (or boron, aluminum, and magnesium). However, it is difficult at present to decide which combination provides optimum specific impulse, because the influence of the specific density on the design and the weight of rocket stages is not sufficiently well known. ESRO

N70-11378# Metallgesellschaft, A. G., Frankfurt am Main (West Germany).
LIGHT WEIGHT METAL HYDRIDES AS ROCKET PROPELLANTS [LEICHTMETALLHYDRIDE ALS RAKETENTREIBSTOFFE]
Funke *In* WGLR Proc. of the 6th WGLR Meeting on Propellants Oct. 1968 p 25–37 In GERMAN (See N70-11376 01-27)
Avail: CFSTI

Among the many hydrides known to exist, lithium and beryllium hydride offer the best properties for rocket propellants. Boranes, magnesium hydride, aluminum hydride, double hydrides, or hydrides containing partly substituted elements are also suitable. The advantages of these compounds are compared and it is concluded that LiH, AlH3 and LiAlH4 are best suited as rocket propellants. ESRO

N70-11379# Kali-Chemie, Hannover (West Germany).
PRODUCTION AND TRANSPORTATION OF LIQUID FLUORINE [PRODUKTION UND TRANSPORT VON FLUESSIGEM FLUOR]
Massonne *In* WGLR Proc. of the 6th WGLR Meeting on Propellants Oct. 1968 p 38–44 In GERMAN (See N70-11376 01-27)
Avail: CFSTI

Production of fluorine is of importance for uranium isotope separation and for providing high energy rocket oxidizers. The technology and the cost of producing it by electrolysis, the liquefaction, transport and storage of liquid fluorine, the corrosion problems, and safety measures are discussed. ESRO

N70-11380# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Trauen (West Germany).
OZONE AND OZONE-OXYGEN MIXTURES AS POSSIBLE HIGH ENERGY OXIDIZERS [UEBER OZON UND OZON-SAUERSTOFF-MISCHUNGEN ALS MOEGLICHE HOCHLEISTUNGS-OXYDATOREN]
D. Genthe *In* WGLR Proc. of the 6th WGLR Meeting on Propellants Oct. 1968 p 45–55 In GERMAN (See N70-11376 01-27)
Avail: CFSTI

The specific impulses of rocket propellants using hydrogen as fuel and different oxidizers, among them ozone, are compared. Although ozone provides maximum specific impulse it is difficult to handle, and therefore the technology of pure ozone and of ozone-oxygen, ozone-fluorine, or ozone-oxygen difluoride is discussed. ESRO

N70-11381# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Stuttgart (West Germany).
NEW RESULTS IN THE LITHERGOLIC COMBUSTION OF LITHIUM HYDRIDE WITH FLUORINE [NEUERE ERGEBNISSE DER LITHERGOLEN VERBRENNUNG VON LITHIUMHYDRID MIT FLUOR
R. Lo *In* WGLR Proc. of the 6th WGLR Meeting on Propellants Oct. 1968 p 56–72 In GERMAN (See N70-11376 01-27)
Avail: CFSTI

The time dependence of several parameters (regression rate, radius of the combustion channel and mass flow rate) for the combustion of solid lithium hydride grains with gaseous fluorine is measured. Empirical laws are derived for these quantities and nozzle efficiency and combustion efficiency are also discussed. ESRO

N70-11382# Boelkow G.m.b.H., Ottobrunn bei Muenchen (West Germany).
MATERIALS HANDLING AND TESTING OF HIGH ENERGY PROPELLANTS IN MICROTHRUSTORS [HANDHABUNG UND ERPROBUNG VON HOCHENERGETISCHEN TREIBSTOFFEN IN KLEINTRIEBWERKEN]
K. H. Krebs *In* WGLR Proc. of the 6th WGLR Meeting on Propellants Oct. 1968 p 73–74 In GERMAN (See N70-11376 01-27)
Avail: CFSTI

The handling and testing of high energy propellants in microthrustors is discussed, using Kerosene, H2/O2, and fluorine. This is a condensed version of a longer Boelkow report. ESRO

N70-11383# Entwicklungsring Nord, Bremen (West Germany).
TRANSPORTATION AND ISOLATION PROBLEMS IN THE USE OF HIGH ENERGY PROPELLANT COMBINATIONS OXYGEN/HYDROGEN [FOERDER- UND ISOLATIONSPROBLEME BEIM EINSATZ DER HOCHENERGETISCHEN TRIEBSTOFFKOBINATIONEN O SUB 2/H SUB 2]
H. Bending *In* WGLR Proc. of the 6th WGLR Meeting on Propellants Oct. 1968 p 75–87 In GERMAN (See N70-11376 01-27)
Avail: CFSTI

In utilizing the high-energy propellant combination O2/H2 a number of problems arise in the design of propellant tanks, combustion chambers, propellant pumps and tank isolation. Problems in pump design are due to the temperature difference between the turbine and the pump, the danger of cavitation in the pump, and the (NPSP) Net Positive Section Pressure requirements. Methods to solve these problems are discussed, requiring extra effort to make the use of this propellant combination feasible. ESRO

N70-11384# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Stuttgart (West Germany).
STORABLE HIGH ENERGY PROPELLANT COMBINATIONS [LAGERFAEHIGE HOCHENERGETISCHE TREIBSTOFFKOMBINATIONEN]
E. W. Schmidt *In* WGLR Proc. of the 6th WGLR Meeting on Propellannts Oct. 1968 p 88–95 In GERMAN (See N70-11376 01-27)
Avail: CFSTI

The storability of liquid propellants is limited by the critical pressure, temperature, freezing point, and decomposition tendency. The applicability of such propellants is compared to that of cryogenic propellants, and the nitrogen fluorides were selected specifically for a closer investigation. For this purpose, laboratory production methods were developed. ESRO

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N70-10099*# Techtran Corp., Glen Burnie, Md.
FRENCH RESEARCH ON TURBOJET NOISE [RECHERCHES FRANCAISES SUR LE BRUIT DES TURBOREACTEURS]
R. Hoch and J. C. Thevenin Washington NASA Oct. 1969 35 p refs Transl. into ENGLISH from the French Presented at the 15th Open Seminar on Acoustics, Poznan, Poland, 19–28 Sep. 1968
(Contract NASw-1695)
(NASA-TT-F-12590) Avail: CFSTI CSCL 21E

The equipment and test installations set up to implement French investigations of turbojet noise are described. Three main lines of research are under way: noise from rotating parts (blowers, compressors, and turbines); pure jet noise; and the air propagation of noise. It is considered that the ideal solution would be to reduce the noise at its source, however, this is an extremely complex problem. Author

N70-10191# La Plata Univ. (Argentina). Dept. of Aeronautics.
LATTICE FOR THE SIMULATION OF THERMAL WALL FLOW IN THE COMBUSTION CHAMBER OF A ROCKET MOTOR [MALLA PARA SIMULACION DE FLUJO TERMICO EN LA PARED DE LA CAMARA DE COMBUSTION DE UN MOTOR COHETE]
Tadeo Hajduk, Nestor Colotta, Carlos Zottig, and Collard Bovy 1968 36 p In SPANISH; ENGLISH summary
(PUBL-95) Avail: CFSTI

The thermal flow in the wall of a combustion chamber in a rocket engine is determined by the application of an analogy existing between a bidimensional thermal and electrodynamic field. This analogy applies an electrical resistance to simulate the dissipative parameter of the thermal resistance; as the field is considered in steady state condition, the parameter of the thermal capacity is eliminated. Two families of curves are determined: equipotential lines, and flow lines. The application of a resistance network is advantageous giving rapidly a great number of exact solutions to a range of boundary conditions. Results were obtained for eleven sets of boundary conditions. Author

N70-10222# Aeronautical Research Labs., Melbourne (Australia).
A PROPOSAL FOR A LIFE METER FOR TURBINE BLADES IN AERO ENGINES
F. J. P. Wood Apr. 1969 19 p refs
(ARL/ME-307) Avail: CFSTI

The effects of temperature and stress on aero engine turbine blade life are discussed. A modification to an existing instrument is proposed, to enable the generation of a counting rate proportional to a function of jet pipe temperature and engine speed that should represent approximately the rate of blade creep. The count of such an instrument should give a measure that could usefully be correlated with blade deterioration in service, under conditions of varying stress and temperature, and hence the instrument could be used as a life meter. The principle is illustrated using the example of the Avon engine. Author

N70-10314# La Plata Univ. (Argentina).
SOLUTION TO THE PROBLEM OF HEAT TRANSPORT IN A LIQUID PROPELLANT ROCKET ENGINE [SOLUCION DEL TRANSPORTE DE CALOR EN UN MOTOR COHETE DE COMBUSTIBLE LIQUIDO]
P. J. Ringegni and A. Toporkov 1968 19 p refs In SPANISH *Its* Publ. No. 99
Avail: CFSTI

The calculations pertaining to the heat transport originating in a liquid propellant rocket engine is presented for ethyl alcohol fuel with hydrogen peroxide as the oxidant. The fuel was 92% by weight ethyl alcohol, and the oxidant was 90% H2O2. Refrigeration was effected by a regenerative method of helicoids using concentrated hydrogen peroxide as a refrigerant, and by film cooling of the fluid injected directly into the nozzle zone. Transl. by F.O.S.

N70-10545# Aeronautical Research Labs., Melbourne (Australia).
INVESTIGATION OF THE STABILITY OF A COMPOUND SHAFT SYSTEM
N. S. Swanson Mar. 1969 28 p refs
(ARL/ME-306) Avail: CFSTI

Types of instability which can cause excessive vibrations in shaft systems are outlined, and methods for calculating critical speeds are reviewed. Using the Myklestad–Prohl model with transfer matrix equations, a mathematical analysis of the critical speeds of a compound shaft system is developed, for which a computer program has been written. The principal limitation when the model is applied to a specific turbine engine shaft system is

the values used for bearing support parameters. For a number of these parameters, values have been derived from experimental vibration data. The problem of oil whirl is also briefly reviewed, and the possibility of oil whirl instability in the system is assessed. Author

N70-10550# La Plata Univ. (Argentina). Dept. of Aeronautics.
PREPLANNING FOR A ROCKET ENGINE OF 1000 kg THRUST WHOSE PROPELLANT IS 90 PERCENT CONCENTRATED HYDROGEN PEROXIDE BY WEIGHT AND ETHYL ALCOHOL [ANTEPROYECTO DE UN MOTOR COHETE DE 1000 KG DE EMPUJE CUYOS PROPULSANTES SON PEROXIDO DE HIDROGENO CONCENTRADO 90 PERCENT EN PESO Y ALCOHOL ETILICO]
P. J. Ringegni and A. Toporkov 1968 17 p In SPANISH
(Publ-92) Avail: CFSTI

The chemical and physical properties of ethyl alcohol and hydrogen peroxide are reviewed, and the performance and reaction kinetics of the propellant is calculated. Drawings of the rocket engine and its propulsion system are included. Transl. by F.O.S.

N70-10665# ARO, Inc., Arnold Air Force Station, Tenn.
DEVELOPMENT OF A DOUBLE OBLIQUE SHOCK SCRAMJET MODEL IN A SHOCK TUNNEL Final Report, Feb. 1967 - Sep. 1968
T. I. Osgerby; H. K. Smithson, and D. A. Wagner Arnold AF Sta., Tenn. AEDC Aug. 1969 56 p refs
(Contract F40600-69-C-0001)
(AD-692466; AEDC-TR-69-59) Avail: CFSTI CSCL 21/5

A double-oblique-shock scramjet model has been developed using the AEDC-VKF 16-in. Shock Tunnel I at a free-stream Mach number of 11. The model was developed as a test bed for the development of instrumentation and hydrogen fuel injection techniques for supersonic combustion experiments to be conducted at the 54-in. test section in the AEDC-VKF Tunnel F. Difficulties were encountered, especially at the entrance to the combustor because of the combined action of separation and the interaction of the second shock from the cowl lip. Considerable effort was expended before these influences were reduced to the point that the flow in the combustor was satisfactory. The results of these development tests are reported here. Author (TAB)

N70-10857# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TURBINE ROTOR WHEEL
V. I. Dumov et al 10 Jun. 1969 6 p Transl. into ENGLISH from Russian Patent no. 193839 (Appl. no. 1054162/24-6, 31 Jan. 1966) 1 p
(AD-692499; FTD-HT-23-133-69) Avail: CFSTI CSCL 21/5

The document introduces a turbine rotor wheel with a blade cascade. In order to increase efficiency over a wide operational range, the cascade consists of rows of blades staggered with respect to one another down the flow to increase the solidity in the zone where the flow turns. Author (TAB)

N70-10880# Akademiya Nauk URSR, Kiev.
ON DESIGNING GAS EJECTION BURNERS
G. P. Dobrovolskiy *In its* Processes of Combust. and Heat Treat. of Mater. 1967 p 35-39 In RUSSIAN (See N70-10876 01-33)
Avail: CFSTI

Assuming that a gas flowing from a nozzle expands to normal pressure at a given temperature, and that air enters the mixer under the same conditions, the size of the ejection burner can be calculated from the gas pressure in front of the nozzle. The length of the mixer can be calculated from the flow rate of the air-gas mixture and from the pressure at the nozzle outlet. Transl. by R.B.

N70-10973*# TRW Systems Group, Redondo Beach, Calif.
NITROGEN TETROXIDE FLOW DECAY STUDY FOR THE ORBITAL WORKSHOP PROPULSION SYSTEM Final Report
M. J. Makowski and J. L. Reger Jun. 1969 228 p refs
(Contract NAS8-21489)
(NASA-CR-102313; TRW-12243-6002-R000) Avail: CFSTI CSCL 21H

This report describes the results of a flow decay study performed on the N2O4 feed lines, valves, and filters of the Orbital Workshop Propulsion System. The system was exposed to off limit (high and low) environmental temperatures during the course of the flow experiments. Additional efforts were directed toward the effect of oxidizer compatibility with the braze alloy planned for system assembly, and upon the effects of artificial propellant aging. Engine flow variations did not exceed 10 percent when operating between 90 F and 50 F using specification grade nitrogen tetroxide, and 12 percent when using artificially aged propellant. Isolation valve variations did not exceed 9 percent when operating between 90 F and 50 F using specification grade and 7 percent when using artificially aged nitrogen tetroxide. Engine flow decay did not exceed 10 percent when operating between 90 F and 50 F using specification grade nitrogen tetroxide, and 5 percent when using artificially aged propellant. Isolation valve flow decay did not exceed 4 percent when operating between 90 F and 50 F using specification grade nitrogen tetroxide, and 5 percent when using artificially aged propellant. Author

N70-10980# Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick (West Germany). Inst. für Strahlantriebe.
INVESTIGATIONS OF A SYSTEM FOR THE THRUST CONTROL OF HIGH ENERGETIC ROCKET ENGINES [UNTERSUCHUNGEN ZU EINEM SYSTEM ZUR SCHUBREGELUNG VON HOCHENERGETISCHEN RAKETENTRIEBWERKEN]
Winfried Buschulte Oct. 1968 31 p refs In GERMAN; ENGLISH summary
(DLR-FB-68-57) Avail: CFSTI

A new injector system, which is simple and suitable for the practical design of thrust control equipment is described. This principle assumes one component of the propellant system to be gaseous when injected into the combustion chamber. Thus it is especially suited for all propellant systems using hydrogen as fuel. Preliminary tests using a model rocket motor with approximately 60 kp of sea-level thrust burning gaseous hydrogen and liquid oxygen, served to functionally investigate the system, especially under partial thrust. Test results on the efficiency of energy conversion in the chamber and the heat transfer into the coolant for different injector systems indicate useful investigations, which could lead to better performance of this system. Author (ESRO)

N70-11020*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF PULSE PRESSURE DISTORTIONS IMPOSED ON THE INLET OF A TURBOFAN ENGINE
Leon M. Wenzel Washington Nov. 1969 17 p refs
(NASA-TM-X-1928) Avail: CFSTI CSCL 21E

A YTF-30-P-1 turbofan was operated in an altitude chamber. A distortion device capable of effecting pulse depressions in inlet pressure was installed ahead of the engine. The pulses could be varied in duration and amplitude. The portion of the inlet duct subjected to distortion could be varied circumferentially from 60 deg to 360 deg in 60 deg sectors. The engine stall sensitivity as a function of pulse duration and distortion sector angle was mapped. The amplitude of pulse necessary to stall the engine was found to be an inverse function of pulse duration. The engine was most sensitive to distorted sectors of 180 deg and 240 deg. Transient

recordings of engine pressures and pressure ratios during stall are presented. Also, data are presented which indicate the circumferential propagation rate of a pressure pulse traveling through the engine to be 20 deg per stage. Author

N70-11144# Fenwal, Inc., Ashland, Mass.
STUDY OF FLAME PROPAGATION THROUGH AIRCRAFT VENT SYSTEMS Final Report
J. P. Gillis Aug. 1969 100 p
(Contract FA-67-WA-1704)
(AD-692463; NA-69-32; DS-68-20) Avail: CFSTI CSCL 21/4

The purpose of the study was to investigate flame propagation in the vent systems of turbine aircraft under simulated flight and ground operating conditions. The function of a venting system is to keep the pressure differential across the walls of aircraft fuel tanks to a minimum during refueling and during the most rapid altitude changes that the aircraft can experience. The vent systems are often designed to prevent spillage of liquid fuel from the aircraft by the utilization of dead-ended sections of vent ductwork and/or fuel slosh collection tanks. The hazard associated with aircraft fuel vent systems is attributed to the fact that the fuel vapors handled by the vent systems are flammable in air under certain conditions. When these conditions exist and an ignition source of sufficient energy is present, the fuel vapor-air mixture will ignite. The combustion process following ignition in a mock-up aircraft vent system has been investigated. Author (TAB)

N70-11188# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Tech. Div.
ENGINEERING CALCULATIONS FOR GAS TURBINE ENGINES BY THE METHODS OF SMALL DEVIATIONS
A. Ya Cherkez 3 Feb. 1969 359 p refs Transl. into ENGLISH of the book "Inzhenernyye Raschety Gazoturbinnykh Dvigateley Malykh Otkloneniy" Moscow, Izd-Vo Mashinostr., 1965 355 p
(Contract F33657-68-D-0865-P002)
(AD-692495; FTD-HT-23-573-68) Avail: CFSTI CSCL 21/5

This book is intended for engineers engaged in the research, development, and designing of stationary and aviation gas-turbine engines and it may also be useful to professors and student in schools of higher education. A simple method is presented of calculating the interdependence of the working process parameters of all contemporary types of gas-turbine engine arrangements, i.e., turbojet, engines with two-stage compressors, and so forth. The effect of variations in parameters or the chracteristics of engine components, e.g., coefficient of losses, efficiency, etc., on thrust, power, air intake, and fuel are calculated by the method of small deviations and converted into a system of linear algebraic equations, which yield both general and specific answers to practical problems. Examples illustrating the use of the method are given and the limitations of the method as well as its margin of error are also covered. Author (TAB)

N70-11241*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ION BEAM DEFLECTOR Patent Application
Bruce A. Banks, inventor (to NASA) and Harold R. Kaufman, inventor (to NASA) Filed 6 Jun. 1969 8 p
(NASA-Case-LEW-10689-1; US-Patent-Appl-SN-830978) Avail: CFSTI CSCL 21C

A single grid accelerator system is described which has a capability of electrically orienting the thrust vector of an electrostatic ion thruster. Emphasis is placed on such a system to enable a single thruster to apply forces of torques on a spacecraft. Highly negative potentials are applied to conductors that are mounted in pairs and arranged in arrays to form the grid. These potentials are independently varied in each array to obtain the desired amount of ion beam vectoring to produce yaw, pitch, and roll forces. The thrust vectoring grid allows acceptable thrust performance at low specific impulses. This is the result of the efficient ion extraction capability of the glass coated grid system. NASA

N70-11361*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF INLET AIR VITIATION ON THE PERFORMANCE OF A MODULAR COMBUSTOR BURNING NATURAL GAS FUEL
Arthur M. Trout and Nicholas R. Marchionna 31 Oct. 1969 16 p refs
(NASA-TM-X-52711) Avail: CFSTI CSCL 21E

An advanced turbojet combustor design was tested with natural gas fuel at a pressure of 45 psia(31 N/sq cm) and inlet air temperature of 540 F (556 K). The inlet air was heated using both nonvitiating and vitiating preheaters. Combustion efficiency of the test combustor substantially decreased when the vitiating preheater was used. The combustion efficiency decreased most at high reference velocities and low fuel-air ratios. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N70-10157# Illinois Univ., Urbana. Electrical Engineering Dept.
A STUDY OF LATITUDE DEPENDENCES OF RADIO STAR SCINTILLATION Final Report
G. W. Swenson, Jr. and B. J. Flaherty Mar. 1969 4 p
(Grant NSF-21070)
(PB-184050) Avail: CFSTI CSCL 03B

To verify the existence of a mid-latitude scintillation boundary for cosmic sources, similar to that observed with radio transmissions from earth satellites, the University of Illinois has had in operation three radio interferometers in the 73.8 MHz radio astronomy band. They have been in operation from the minimum phase of the present solar cycle (January 1963)until the near maximum phase (January, 1969). This long period of observation was required to collect sufficient data to have meaningful statistics. The percent of time that scintillation will be observed increases with increased solar activity. At present all the stations have been closed and data is being prepared for analysis. USGRDR

N70-10401*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC RAYS Contributions to the 1969 Budapest Conference
Sep. 1969 213 p refs Papers presented by NASA at 11th Intern. Conf. on Cosmic Rays
(NASA-TM-X-63711; X-611-69-413) Avail: CFSTI CSCL 04A

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9. COMPOSITION OF RELATIVISTIC COSMIC RAYS DETECTED ON GEMINI XI F. W. O'Dell, M. M. Shapiro, R. Silberberg, B. Stiller, C. H. Tsao (NRL, Washington, D.C.) et al p 127–139 refs (See N70-10410 01-29)

10. DELAYED APPEARANCE OF RELATIVISTIC ELECTRONS 5 DAYS AFTER A SOLAR FLARE G. M. Simnett, T. L. Cline, S. S. Holt, and F. B. Mc Donald p 141–157 refs (See N70-10411 01-29)

11. CO-ROTATING MODULATIONS OF COSMIC RAY INTENSITY DETECTED BY SPACECRAFTS SEPARATED IN SOLAR AZIMUTH R. P. Bukata, R. A. R. Palmeira (Southwest Center for Advanced Studies), V. K. Balasubrahmanyan, and E. C. Roelof p 159–173 refs (See N70-10412 01-29)

12. SPECTRAL VARIATIONS IN SHORT TERM (FORBUSH) DECREASES AND IN LONG TERM CHANGES IN COSMIC RAY INTENSITY D. Venkatesan (Calgary Univ.) and V. K. Balasubrahmanyan p 175–195 refs (See N70-10413 01-29)

13. HIGH ENERGY PRIMARY COSMIC RAY PROGRAM OF GODDARD SPACE FLIGHT CENTER J. F. Ormes and V. K. Balasubrahmanyan p 197–209 refs (See N70-10414 01-29)

N70-10402*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GAMMA-RAY ASTRONOMY RESULTS AT BALLOON ALTITUDES

D. A. Kniffen, C. E. Fichtel, and H. B. Oegelman *In its* Cosmic Rays Sep. 1969 p 1–14 refs (See N70-10401 01-29)

(OG-18) Avail: CFSTI CSCL 04A

Results of several balloon flights of a digitized gamma-ray spark chamber have failed to detect a point source of gamma-rays greater than 30 MeV. Upper limits to the fluxes emitted by possible discrete sources are presented. The intensity, energy spectrum and zenith angle dependence of the atmospheric gamma-rays were also measured. The observed downward intensity is in reasonable agreement with other measurements; however, the upward moving intensity > 100 MeV is a factor of about 3 lower than the OSO-3 result. Preliminary results from a July 1969 balloon flight of a new 50 cm by 50 cm spark chamber gamma-ray telescope are presented. The results do not indicate a detectable line intensity in the galactic longitude interval at about 142.5 deg to 194.0 deg. Author

N70-10403*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SEARCH FOR SHORT PULSES OF ENERGETIC PHOTONS FROM SUPERNOVAE USING THE ATMOSPHERIC FLUORESCENCE

H. Oegelman and D. Bertsch *In its* Cosmic Rays Sep. 1969 p 15–35 refs (See N70-10401 01-29)

Avail: CFSTI CSCL 04A

Recent theories on supernova explosion and subsequent neutron star formation indicate that during gravitational collapse when the outer shells of the star might be accelerated to cosmic ray velocities, a short time-scale (approximately microseconds) burst of energetic photons should also be generated. A wave front of energetic photons passing the Earth would be absorbed in the atmosphere and would induce fluorescence emission. In this paper, a photomultiplier system designed to observe the secondary fluorescence light is described. This system has been in operation since September 1968. An upper limit to the rate of supernova like events is given as one per 86 hours at sensitivity levels discussed in the text. A second system was put into operation in June 1969. The two stations are now operating in coincidence over a baseline of 175km to remove local noise sources. In 45 hours of observation only lightning like events have been observed in coincidence. Author

N70-10404*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COSMIC-RAY ELECTRONS AND POSITRONS OF ENERGIES 2 TO 9.5 MeV OBSERVED IN INTERPLANETARY SPACE

T. L. Cline and G. Porreca *In its* Cosmic Rays Sep. 1969 p 37–49 refs (See N70-10401 01-29)

(OG-26) Avail: CFSTI CSCL 04A

The differential energy spectra of electrons and positrons in the 2 to 9.5 MeV interval have been studied in interplanetary space during solar quiet times following March 1968 with the OGO-5 satellite. The detector flown was designed to separately identify cosmic-ray and solar electrons, positrons, protons and alphas, and solar x-rays; it used new techniques to minimize its background and to determine directly the background encountered. The observed quiet-time electron spectrum, approximately of the form 90E to the minus 1.5 power, m to the minus 2 power, sec to the minus 1 power, ster to the minus 1 power, MeV to the minus 1 power from 2 to 9.5 MeV, roughly agrees with the excpected unmodulated cosmic-ray knock-on electron spectrum. The positron to electron ratio, totalled for this energy interval, is only 1.8 percent. This is the lowest e(+)/e ratio measured in any energy region; it also suggests that this electron component is of knock-on or directly -accelerated origin, rather than of meson-decay of soft-shower origin. The resulting average positron intensity, near 0.2 m to the minus 2 power, sec to the minus 1 power, ster to the minus 1 power, MeV to the minus 1 power, compares with the balloon data above 10 MeV such that all points or upper limits are below the predicted spectrum of cosmic-ray electrons from pion decay by a factor of up to ten. Author

N70-10405*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TIME VARIATIONS OF THE 4 TO 12 MeV INTERPLANETARY ELECTRON INTENSITY BETWEEN 1963 AND 1968

G. M. Simnett, T. L. Cline, and F. B. Mc Donald *In its* Cosmic Rays Sep. 1969 p 51–66 refs (See N70-10401 01-29)

Avail: CFSTI CSCL 04A

The interplanetary electron intensity between 4 and 12 MeV has been monitored with the IMP–1, –3, and –4 spacecraft. There are a variety of types of time variations in the intensity; these include flare-associated and recurrent solar electron events, and other short-term effects, such as small quiet-time increases and Forbush decreases, superimposed on the longer-term modulation. The quiet-time intensity increases are strongly correlated with solar rotation, but are generally not coincident with increases of the low-energy proton intensity; in fact, there is frequently an anticorrelation between the two. This pattern indicates the possibility of a solar origin for the quiet-time increases. However, since the background electron intensity does undergo large Forbush decreases, not coincident with solar-flare electron events, the existence of a real solar modulation of the galactic intensity is also indicated. The overall change in the quiet-time background intensity between

December 1965 at solar minimum and August 1968 is less than a factor of two, but is not interpreted as vanishingly small.
Author

N70-10406*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOW-ENERGY COSMIC RAY POSITRONS AND 0.51 MeV GAMMA RAYS FROM THE GALAXY
R. Ramaty, F. W. Stecker, and D. Misra (Md. Univ., College Park) *In its* Cosmic Rays Sep. 1969 p 67–83 refs (See N70-10401 01-29)
(OG-28) Avail: CFSTI CSCL 04A

Large fluxes of low-energy cosmic rays in interstellar space may produce, via unstable CNO beta-emitters, large fluxes of low-energy positrons and a detectable intensity of 0.51 MeV gamma rays. Even though on a galactic scale these cosmic-ray intensities are probably untenable since they conflict with the dynamics of the interstellar medium, they may exist on a smaller scale of the order of the stopping distances of both low-energy cosmic rays and positrons. Compared are the results of a detailed calculation with direct positron measurements at the earth and the observability of the annihilation radiation above the isotropic X-ray background is discussed.
Author

N70-10407*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY POSITRONS NEAR 1 MeV FROM OTHER THAN THE PION YIELDS MUON YIELDS ELECTRON PROCESS
T. L. Cline and E. W. Hones, Jr. (Los Alamos Sci. Lab.) *In its* Cosmic Rays Sep. 1969 p 85–96 refs (See N70-10401 01-29)
(OG-29) Avail: CFSTI CSCL 04A

Evidence is presented for a spectral component of interplanetary positrons separate from that produced by the decay of interstellar mesons from cosmic-ray interactions. Results from observations made with the OGO-3 satellite indicate the detection of approximately 0.5 MeV positrons with a differential intensity near 100 m to the minus 2 power, sec to the minus 1 power, ster to the minus 1 power, MeV to the minus 1 power, two decades higher than the maximum expected from cosmic-ray meson production. Data, accumulated for nearly two years, have been examined for the existence of temporal or spatial variations; accelerator exposures of the detector have also been made in order to determine if the particles observed in space might be local secondaries. To date, there is no indication of any solar or geophysical production mechanism, or effect local to the detector, which would account for the observed positron rate. The observed cosmic-ray positron intensity, taken to be of cosmic-ray origin, is compared with the calculated values for interstellar beta emission by cosmic-ray excited nuclei; qualitative agreement exists only if a high, possibly local, low-energy cosmic ray intensity is used.
Author

N70-10408*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC-RAY POSITRONS AND NEGATRONS OF ENERGIES 10 TO 250 MeV AT 85 DEG GEOMAGNETIC LATITUDE
D. A. Kniffen, T. L. Cline, and C. E. Fichtel *In its* Cosmic Rays Sep. 1969 p 97–110 refs (See N70-10401 01-29)
Avail: CFSTI CSCL 04A

Measurements of the differential intensities of cosmic-ray positrons and negatrons were carried out with balloon flights near the north geomagnetic pole. The detector used consisted of a magnetic spectrometer incorporating counters and digitized spark chambers; it is capable of identifying incoming electrons and of separating positrons from negatrons from 20 to 250 MeV/c. Results failed to yield measurable intensities of positrons and of negatrons partially because of an instrument malfunction which made the net area-solid angle-collecting time factor similar to the previous year. These findings are compared with other available results from cosmic-ray positron and negatron experiments in the energy region appropriate to interstellar meson production. It is shown that there is considerable depression of the expected positron intensity probably caused by solar modulation effects.
Author

N70-10409*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRA AND CHARGE COMPOSITION OF THE LOW ENERGY GALACTIC COSMIC RADIATION FROM Z EQUALS 2 TO 14
B. J. Teegarden, F. B. Mc Donald, and V. K. Balasubrahmanyan *In its* Cosmic Rays Sep. 1969 p 111–125 refs (See N70-10401 01-29)
Avail: CFSTI CSCL 04A

Results from the cosmic ray experiment on OGO-E for the study of energy spectra and relative abundances are presented and compared with other relevant measurements. Some new features are seen in C/O, C/He and O/He ratios which seem to favor the hypothesis of a two component model for the origin of cosmic rays. A nearer source which supplies most of the cosmic ray particles up to 100 MeV/nucleon seems to have an abundance differing in detail with respect to the high energy cosmic rays particularly in the relative abundances of carbon and oxygen. It appears that all the features seen in the experimental results are not easily explained by considering a single source and different propagation models for path length distributions.
Author

N70-10410*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPOSITION OF RELATIVISTIC COSMIC RAYS DETECTED ON GEMINI 11
F. W. O'Dell (NRL, Washington, D.C.), M. M. Shapiro (NRL, Washington, D.C.), R. Silberberg (NRL, Washington, D.C.), B. Stiller (NRL, Washington, D.C.), C. H. Tsao et al (NRL, Washington, D.C.) *In* ITS Cosmic Rays Sep. 1969 p 127–139 refs (See N70-10401 01-29)
Avail: CFSTI CSCL 04A

Presented are final results on the first satellite experiment on abundances of cosmic-ray nuclei having a mean energy of several GeV per nucleon. A nuclear emulsion detector, exposed on Gemini 11 in a near-equatorial orbit ranging between geographic latitudes + or − 29 deg, collected 619 high-quality tracks above the earth's atmosphere. Time resolution was provided by movement of a lower emulsion stack relative to an upper one. The detector was covered by only 0.07 g/sq cm of aluminum, and was favorably oriented for 18 hours. The results on abundances, requiring no correction for secondary production in the atmosphere, are characterized by: (1) a pronounced odd-even effect, with low abundances for elements of atomic number 7, 9, 11 and 13, compared to those of neighboring elements with even Z; (2) approximately equal fluxes of neon, magnesium and silicon, each being about one-fourth that of oxygen; and (3) an abundance gap in the region 15 < or = to Z < or = to 19. The composition is similar to that observed at approximately 100 MeV/nucleon on satellites; however, the abundances of the "heavy" nuclei (Z > or = to 10) relative to oxygen are higher in this experiment by approximately one standard deviation, or approximately 20%, than those at low energies.
Author

N70-10411*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DELAYED APPEARANCE OF RELATIVISTIC ELECTRONS 5 DAYS AFTER A SOLAR FLARE

G. M. Simnett, T. L. Cline, S. S. Holt, and F. B. Mc Donald *In its* Cosmic Rays Sep. 1969 p 141-157 refs (See N70-10401 01-29)

(MO-33) Avail: CFSTI CSCL 04A

An analysis of interplanetary 0.3 - 10 MeV electron and proton intensities between 6 July and 16 July 1968 indicates that the event had some unusual features. Comparison with solar radio, optical and X-ray data indicate that in this case a large electron increase on 13 July was produced at the latest on 8 July. Features of the solar flares from 6-16 July are discussed. The peak electron and 1 - 6 MeV proton intensities on 13 July show an inverse velocity dispersion: the peak electron intensity, for example, occurs 4 hours after the latest proton peak. Discussed are the relative merits of several propagation models: storage or continuous acceleration of electrons at the sun. Author

N70-10412*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CO-ROTATING MODULATIONS OF COSMIC RAY INTENSITY DETECTED BY SPACECRAFTS SEPARATED IN SOLAR AZIMUTH

V. K. Balasubramanyan, E. C. Roelof, R. P. Bukata (Southwest Center for Advanced Studies), and R. A. R. Palmeira (Southwest Center for Advanced Studies) *In its* Cosmic Rays Sep. 1969 p 159-173 refs (See N70-10401 01-29)

Avail: CFSTI CSCL 04A

The daily cosmic ray intensity from the Explorer 18 geiger-counter monitor and Pioneer 6 scintillation telescope have been statistically analyzed by the use of correlation functions. When the two spacecrafts are close to each other, the cross-correlation function agreed closely with the auto-correlation function of either detector, showing that both detectors were responding comparably and reliably to cosmic ray fluxes. When Pioneer 6 and Explorer 18 were separated by approximately 50 deg, the variations in the detector rates appear to be mainly due to galactic cosmic rays. Comparison of neutron monitor rates shows no detectable variations in solar proton outflow of Ep > or ≈ to 50 MeV. The cross-correlation function between the detector during this quiet period reaches a significant peak with a lag of approximately 3 days between data from both satellites. The cross-correlation function is qualitatively similar in form to the auto-correlation function from Explorer 18. It is proposed that there are numerous long lived regions of modulated cosmic ray flux following the general spiral configuration of the interplanetary magnetic field as the field structure co-rotates with the sun. Author

N70-10413*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SPECTRAL VARIATIONS IN SHORT TERM (FORBUSH) DECREASES AND IN LONG TERM CHANGES IN COSMIC RAY INTENSITY

V. K. Balasubrahmanyan and D. Venkatesan (Calgary Univ.) *In its* Cosmic Rays Sep. 1969 p 175-195 refs (See N70-10401 01-29)

(MO-81) Avail: CFSTI CSCL 04A

Data are available from Explorer satellites 18, 21 and 28 and OGO-A on a continuous basis over the period November 1963 - May 1967. The cosmic ray intensity registered on these satellites, of 50 MeV energy is compared with the intensities recorded by neutron monitors, at the equatorial station, Huancayo, at the high latitude station, Deep River, and at the polar station, Alert. Spectral variations during the Forbush decreases and during long term changes in cosmic ray intensity are investigated, and the results discussed in terms of current ideas. Author

N70-10414*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HIGH ENERGY PRIMARY COSMIC RAY PROGRAM OF GODDARD SPACE FLIGHT CENTER

J. F. Ormes and V. K. Balasubrahmanyan *In its* Cosmic Rays Sep. 1969 p 197-209 refs (See N70-10401 01-29)

Avail: CFSTI CSCL 04A

The high energy program attempts to determine the charge composition of the primary cosmic radiation in the energy range 10 to the 10th power eV to 10 to the 14th power eV with a series of experiments carried in balloons and satellites. Particle charge is identified using a four element telescope containing two plastic scintillators, a lucite Cerenkov detector and a CsI(Na) mosaic, each of which is 50 cm x 50 cm. It has a collection factor of 2500 sq cm ster. Uniformity of response and the resolution comparable to that of much smaller detectors is obtained through use of a digitized wire spark chambers for recording particle trajectories. It also allows for identification of multiple particle background events. Electron energy is measured through the development of the cascade shower in a tungsten scintillator sandwich 12 radiation lengths thick. The energy measurement of protons and heavier nuclei are carried out with a total ionization spectrometer in which observations are made at every 1.5 radiation lengths of the number of traversing particles. A successful ballon flight of 30 hrs duration was achieved at 5 GV cut-off. Author

N70-10498*# Uppsala Univ. (Sweden). Cosmic Ray Group.

SOLAR AND GALACTIC COSMIC RAYS AND THE INTERPLANETARY MAGNETIC FIELD, 28 JANUARY - 25 FEBRUARY 1967

Stig Lindgren [1969] 14 p refs Supported by the Swedish Sci. Res. Council and the Swedish Space Committee

(Grant NEL-05-003-017)

(NASA-CR-106636) Avail: CFSTI CSCL 04A

Solar and galactic particle fluxes after the 28 January 1967 particle flare are discussed in relation to interplanetary field observations. A soft pre-event began at 0214 on 28 January. It shows modulation features carried by the solar wind from Explorer 33 to IMP-3. The interplanetary magnetic field shows a sudden, major change of direction in coincidence with the onset of the main event, which begins at 0835. New injections of energetic protons take place late on 2 and 13 February. The enhanced diurnal variation seen by neutron monitors 31 January - 7 February coincides well with a two-fold increase in the magnitude of the interplanetary magnetic field. Several hours before a magnetic storm at the end of this period, the interplanetary magnetic field appears to be strongly squeezed; it enters the ecliptic plane from below at a theta-angle of 60 deg and with a magnitude of 10 gammas. Author

N70-10525# Michigan Univ., Ann Arbor. Dept. of Astronomy.

RELATIONSHIPS BETWEEN SOLAR FLARES AND OTHER ASPECTS OF SOLAR ACTIVITY

D. C. Mohler Aug. 1969 5 p

(Contract N00014-67-A-0181-0001; ARPA Order-215)

(AD-692180) Avail: CFSTI CSCL 4/1

A progress report is given on studies of the relationship between solar flare activity and geomagnetic disturbances. TAB

N70-10578# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
THE SOLAR PROTON EVENTS OF FEBRUARY, 25 AND 27, 1969. PAPER 3: COMPARISON OF PARTICLE MEASUREMENTS CLOSE TO THE EARTH AND IN INTERPLANETARY SPACE
A. Balogh, A. C. Durney, H. Elliot, A. R. Engel, G. E. Morfill et al [1969] 11 p refs Presented at the 11th Intern. Conf. Cosmic Rays, Budapest 1969
Avail: CFSTI

Some simultaneous measurements over the polar caps and in interplanetary space are presented for the February 25 flare event. These confirm the idea that the polar cap flux shows more structure than in interplanetary space, both at 1-2 MeV and at 350 MeV. It is suggested that the cause of the additional structure lies in a modulation introduced by the outer magnetosphere rather than anisotropies or flux gradients in interplanetary space. Author (ESRO)

N70-10579# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
THE SOLAR PROTON EVENTS OF FEBRUARY, 25 AND 27, 1969. PAPER 2: INTERPRETATION OF CORRELATED INTERPLANETARY MAGNETIC FIELD AND PARTICLE MEASUREMENTS
J. J. Quenby, A. Balogh, A. R. Engel, H. Elliot, P. C. Hedgecock et al [1969] 17 p refs Presented at the 11th Intern. Conf. Cosmic Rays, Budapest, 1969
Avail: CFSTI

Particle and field measurements on the February 25, 1969 solar proton event are consistent with an anisotropic, velocity dependent diffusion model at low energies with a mean free path similar to 10 to the 12th power cm. The local interplanetary field strongly influences the measured particle anisotropy. Author (ESRO)

N70-10588# Uppsala Univ. (Sweden). Inst. of Physics.
CHANGES OF THE RIGIDITY DEPENDENCE AND THE DAILY VARIATION DURING COSMIC RAY DECREASES
Bo Oestman and Ezzat Awadalla [1969] 11 p refs
Avail: CFSTI

The drop of the cosmic ray intensity after a Forbush decrease is studied using an exponential curve describing the recovery. The curve gives an accurate determination of the drop of the intensity as a mean for a period of the recovery. The cosmic ray decreases occurred from August 1957 through December 1959. The decreases, determined by the rate of onset, are divided into three groups: swift, intermediate, and slow. Recovery rate is constant for some decreases and not constant for others. One form of cosmic ray decrease is the corotating originally produced in the region of interplanetary space apart from the position of the earth. The other form is a developing one, the result of a prominent solar flare, which is produced in the region of the interplanetary space where the earth is situated. There is a slight difference in the rigidity dependence between the two main forms. The planetary diagram was used for computing the time of maximum and the amplitude of the daily variations. Author

N70-10652# Technische Hochschule Munchen (West Germany). Fakultat fuer Allgemeine Wissenschaften.
INVESTIGATION OF MULTIPLE SCATTERING OF ELECTRONS IN SPARK CHAMBERS WITH REGARD TO ENERGY AND DIRECTION DETERMINATION OF COSMIC GAMMA RADIATION [UNTERSUCHUNG DER VIELFACHSTREUUNG VON ELEKTRONEN IN FUNKENKAMMERN IM HINBLICK AUF ENERGIE- UND RICHTUNGSBESTIMMUNG KOSMISCHER GAMMASTRALUNG]
Hans Mayer-HaBelwander (Ph.D. Thesis) 1969 118 p refs In GERMAN
Avail: CFSTI

Investigated were physical properties of spark chambers and the application of electron pair multiple scattering to determine gamma quantum energies. A computer program was used to evaluate registered monoenergetic electron scattering paths and to compare scattering distributions with the Moliere's multiple scattering theory in correlation with the geometry of the spark chamber. Also studied were the effects of single scattering law and small angle approximation on the accuracy of Moliere's theory by comparison with corresponding exact theories of Goudsmit and Saunderson. It was concluded that the errors in Moliere's theory are negligible for the considered energy region. Transl. by G.G.

N70-10687*# Uppsala Univ. (Sweden). Cosmic Ray Group.
ANOMALOUS STREAMING OF COSMIC RAYS
Stig Lindgren [1969] 10 p refs Sponsored in part by Swiss Sci. Res. Council and Swed. Space Comm.
(Grant NGL-05-003-17)
(CR-106635) Avail: CFSTI CSCL 04A

A description is given of three cases of pronounced cosmic ray anisotropy in which the excess flux of BeV protons comes from the 6 to 12 hour quadrant outside the geomagnetic field. It is argued that the observed streaming is due to restoration processes triggered by a severe reduction of the cosmic ray density east of the extrapolated sun - earth line. Author

N70-10723*# Pittsburgh Univ., Pa. Space Research Coordination Center.
ION COMPOSITION AND ION CHEMISTRY IN AN AURORA
T. M. Donohue, E. C. Zipf, Jr., and T. D. Parkinson 23 Jul. 1969 40 p refs
(Contract NASR-179; Grant NGL-39-011-002; Contract DA-31-124-ARO(D)-440; Grant NSF GA-1237)
(NASA-CR-106649; SRCC-99) Avail: CFSTI CSCL 04A

Ion composition measurements are reported as obtained with a rocketborne mass spectrometer flown during an aurora. At the level of highest ion production near 115 km the NO(+) density was a factor of 3 larger and the O2(+) density, a factor of 10 smaller than expected from normal composition, temperature and ion chemistry models. The O(+) density was a factor of 50 larger than expected. The results appear to demand effective ion temperatures greater than 1000 K and electron temperatures even larger. They also require efficient channels for conversion of O2(+) to NO(+). Reactions of O2(+) with anomalously abundant NO or N with vibrationally excited N2 are regarded as possible modes for transforming O2(+) into NO(+). Densities of He(+) in excess of 50/cu cm were observed and not understood. The O2(+) densities measured are too low to permit dissociative recombination to contribute significantly to OI green line excitation except at high altitude. Author

N70-10760# Universidad Mayor de San Andres, La Paz (Bolivia). Laboratorio de Fisica Cosmica.
WORK RESUMES, 1968 [RESUMEN DE LABORES, ANO 1968]
Gaston R. Mejia, ed. Feb. 1969 100 p refs In SPANISH

Its Cuaderno No. 33
Avail: CFSTI

A summary of the developments Cosmic Physics is presented. Areas reported are: (1) scientific investigations by the laboratory, (2) unusual increases in the intensity of cosmic radiation, (3) increase in the cosmic radiation during the magnetic storm of 14 December 1966, (4) variations with the solar cycle of diurnal variations in cosmic radiations, detected underground, (5) experiment with nuclear explosions, (6) study of large and widespread disturbances in the atmosphere, (7) polarization of radio pulses produced by extensive storms in the atmosphere, and (8) abstracts of published articles. Transl. by F.O.S.

N70-10771# Uppsala Univ. (Sweden). Inst. of Physics.
ON THE 27-DAY RECURRENCY IN COSMIC RAY INTENSITY AND GEOMAGNETIC K SUB p DATA
Eric Dyring, Hans Hauska, and Birgitta Kangedal 1968 14 p refs
(MO-95) Avail: CFSTI

Daily geomagnetic K sub p data during the period 1932-1968 and daily cosmic ray intensities of the Deep River NM 64 neutron monitor, 1962-1968, were analysed to examine the periodic variations in the frequency band 0.02 – 0.2 c/days. Filter and power spectrum methods are used on a yearly and biyearly basis. A well defined 27 day recurrency effect is observed in both geomagnetic and cosmic ray data. However, the shape and the largeness of the effect varies considerably from year to year and between the two types of data. The geomagnetic K sub p data show marked overtones of 27 day period for many years, which is not observed in the cosmic ray data. These overtones, when prominent, are tentatively associated with the quasi-stable sector structure in the interplanetary magnetic field. Using a band pass filter the 27 day waves in the cosmic ray intensity are uncovered. This operation is repeated after excluding some prominent Forbush decreases. Author

N70-10772# Uppsala Univ. (Sweden). Cosmic Ray Group.
STATISTICAL RELIABILITY TESTS OF COSMIC RAY INTENSITY DATA
Eric Dyring and Bert Sporre [1968] 7 p refs
(MO-61) Avail: CFSTI

A system of statistical methods to test on a routine base the reliability of cosmic ray intensity records from ground stations is presented. The methods include both internal comparisons of the individual sections of the instrument and comparisons with data from other stations. It is stressed that the time series aspect is essential. Author

N70-10773# Uppsala Univ. (Sweden). Cosmic Ray Group.
A SEARCH FOR RAPID PERIODIC VARIATIONS IN THE GALACTIC COSMIC RAY INTENSITY, 1 JANUARY – 23 MARCH 1969
S. Ruthberg, E. Dyring, S. Lindgren, B. Sporre, B. Oestman et al 23 Mar. 1969 11 p refs
(MO-102) Avail: CFSTI

Powerful cosmic ray instruments with high counting rates enable persistent periodic variations in the frequency region to be taken. Five minute data was studied from a NM 64 neutron monitor in Oulu, an IGY neutron monitor in Uppsala, and a meson scintillation telescope in Uppsala over the period 1 Jan. – 23 March 1969. Different time series methods have been used in an attempt to extract periodic variations in the frequency range 0.12 – 6 c/h. The results show no trace of periodic variations for this particular period. However, a significant peak was found at 0.5 c/h for the period 20 Aug. – 23 Oct. 1967 in the IGY neutron monitor. It seems reasonable to study periodic and nonperiodic short term variations more systematically. Author

N70-11028*# Bell Telephone Labs., Inc., Murray Hill, N.J.
PARTICLE DETECTION EXPERIMENT FOR APPLICATIONS TECHNOLOGY SATELLITE 1 (ATS-1) Final Report
W. M. Augustyniak, I. Hayashi, H. E. Kern, R. W. Kerr, L. J. Lanzerotti et al 1 May 1969 273 p refs Prepared for Western Elec. Co., Inc., New York
(Contract NAS5-9635)
(NASA-CR-106637) Avail: CFSTI CSCL 04A

The experiment on ATS-B has been designed to measure the energy spectra of electrons and protons at the synchronous satellite altitude in order to study the systematic day-night variations in the trapped particles arising from the distortion of the earth's magnetic field by the magnetospheric boundary with the solar wind, the perturbations in the trapping associated with magnetic storms, and the long-term changes in the particles during the time of increasing solar activity. The telescope provides spectral information for electrons in the 0.4- to 3-MeV energy range and for protons in the 0.6- to 22-MeV energy range. The experiment also permits investigation of the possible existence of alpha particles within the magnetosphere in the energy range from approximately 6 to 85 MeV. Author

N70-11063*# California Univ., Berkeley. Space Sciences Lab.
MAGNETIC FIELD VARIATIONS IN INTERPLANETARY SPACE
John M. Wilcox 26 Aug. 1969 30 p refs Presented at 3rd ESLAB/ESRIN Symp., Intercorrelated Satellite Observations Related to Solar Events, Noordwijk, Neth., Sep. 1969 *Its* Ser. No. 10, Issue No. 39
(Grant NGR-05-003-230; Contract Nonr-3656(26); Grant NSF GA-1319)
(NASA-CR-106726) Avail: CFSTI CSCL 04A

Magnetic field variations and structures in interplanetary space are described and related to the sun. Discrete flare-related effects in the interplanetary medium occur within a large-scale interplanetary sector pattern related to a solar sector pattern that is ordered over a large extent in heliographic latitude and longitude. A random walk transport of photospheric field lines slightly modifies the over-all ordered pattern, but sector boundaries appear to resist the random walk process. There is a delay of approximately one solar rotation between appearance of an active region and its possible effect on the interplanetary sector pattern. A flare occurrence is most probable near a solar sector boundary. Author

N70-11138# European Space Research Organization, Paris (France).
ENVIRONMENTS AND THEIR ROLE IN SPACECRAFT TECHNOLOGY: VOLUME 4: RADIATION EFFECTS
Feb. 1969 93 p refs Partly in FRENCH and partly in ENGLISH Proc. of the 6th ESRO Summer School Noordnijk, Neth., Aug. – Sep. 1967
(ESRO-SP-43) Avail: CFSTI

CONTENTS:

1. SURFACE AND BULK EFFECTS DUE TO SPACE RADIATIONS IN ELECTRONIC COMPONENTS R. A. Reid p 5–46 refs (See N70-11139 01-09)

2. RADIATION EFFECTS ON MATERIALS IN SPACE J. Dauphin p 49– 96 refs (See N70-11140 01-18)

N70-11146# Uppsala Univ. (Sweden). Cosmic Ray Group.
TIME DEPENDENCE OF THE POSITION OF THE COSMIC RAY EQUATOR
Bert Sporre and Martin A. Pomerantz [1969] 15 p refs Sponsored by the Natl. Geograph. Soc.
Avail: CFSTI

An extensive series of measurements of the variation in

the cosmic ray intensity as a function of geographic position was conducted with a shipboard neutron monitor during the unusually active solar maximum period that coincided with the International Geophysical Year to locate the cosmic ray equator at a fixed meridian precisely, and to determine whether this point of minimum cosmic ray intensity varied with time. During the solar maximum epoch, the shipboard neutron monitor traversed the equator off the west coast of Africa ten times and in the Indian Ocean twice. Although solar and geophysical activity varied considerably during the period of the measurements, the location of the cosmic ray equator appeared to have remained fixed to within approximately one degree. However, the possibility of a small progressive change of about the magnitude of the experimental uncertainty could not be precluded. Author

N70-11147*# Michigan Univ., Ann Arbor. Radio Astronomy Observatory.

DYNAMIC SPECTRA OF 4-2 MHZ SOLAR BURSTS: RESULTS FROM ORBITING GEOPHYSICAL OBSERVATORY 3 Final Report, Part 1: Scientific

Thomas E. Graedel (Ph.D. Thesis) [1968] 213 p refs *Its* Pt-1
(Contract NAS5-2051)
(NASA-CR-106640) Avail: CFSTI CSCL 04A

The data collected by OGO-3 in detecting solar bursts are analyzed quantitatively at selected frequencies. The burst data are plotted as graphs of output voltage against time. The OGO-3 spacecraft, the radio astronomy experiment, and observed properties of the solar radio bursts are described. The physical conditions of the corona, and the evidence for a plasma frequency burst hypothesis are reviewed. Conclusions which were drawn are summarized as follows: (1) Solar fast drift radio bursts with peak flux densities in the 4 to 2 MHz band were observed at the rate of one burst for 50 hours of observation. (2) Type V continuum was observed in 2% of all cases following fast drift bursts at low frequencies. (3) The detection of a reverse drift burst at low frequencies may indicate the presence of significant magnetic fields transverse to the radial direction at distances of approximately 5 solar R. F.O.S.

N70-11175# Dabcovich and Co., Inc., Lexington, Mass.

PROJECTS IN OSO-3 SOLAR ULTRAVIOLET DATA ANALYSIS, IONOSPHERIC PHYSICS, SCATTERING PHENOMENA AND INNOVATIVE COMPUTER TECHNIQUES Final Report, 29 Apr. 1968 – 30 Apr. 1969

Robert F. Boudreau, Milan R. Dabcovich, Kenneth Dieter, Philip A. Grossman, Harriett Korff et al Jul. 1969 152 p
(Contract F19628-68-C-0315)
(AD-692520; AFCRL-69-0330) Avail: CFSTI CSCL 4/1

The report is presented in two parts. Part I describes the program written to process ultraviolet measurements from the OSO-III satellite, the logical procedures and computations are explained. Sufficiently detailed information is included to allow the user to set up computer runs. Part II furnishes theoretical and practical descriptions of nine computer programs written for projects which include: ionospheric drift investigations, network synthesis, analysis of experimental EEG data, Lunar Laser Range Finder Development, hydrogen-electron scattering, determination of the roots for a sixth degree polynomial and providing a linear fit for a decay type algebraic equation. Author (TAB)

N70-11193# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.

THE ENTRY OF SOLAR PROTONS INTO THE GEOMAGNETIC FIELD DURING THE EVENT OF JUNE 9, 1968

J. J. Quenby [1969] 10 p refs
Avail: CFSTI

The minimum latitudes of arrival for solar protons in the energy range 2 MeV to 90 MeV are found. The particles arrive at latitudes lower than would be expected on a field model determined by the internal field, the magnetospheric boundary currents, the magneto-tail and the ring current. At quiet times, scattering by waves in the magnetosphere may explain the anomalous entry but during the main phase of a magnetic storm drift motion caused by electric fields associated with the build-up of the main phase ring current seems to be important. Author (ESRO)

N70-11215# Danish Meteorological Inst., Copenhagen. Geophysics Section.

THE ELECTRON CONTENT IN THE AURORAL AND MID-LATITUDE REGION

Ib Steen Mikkelsen Apr. 1969 24 p refs
(Contract AF-61(052)-828)
(AD-691910; AFCRL-69-0150; Rept-10) Avail: CFSTI CSCL 4/1

The total electron content in the ionosphere observed at Narssarssuaq, Denmark, is discussed as a result of the competition between mechanisms forming the mid-latitude ionosphere and mechanisms related to the auroral oval. Author (TAB)

N70-11232*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MeV PARTICLES IN THE OUTER ZONE: EXPLORER 12

Richard L. Kaufmann and Andrei Konradi Feb. 1969 31 p refs
Prepared in cooperation with New Hampshire Univ.
(Grants NSF GP-5255; NSF GA-1131)
(NASA-TM-X-62507; UNH-R-69-5) Avail: CFSTI CSCL 04A

Fluxes of 100 kev electrons and protons on high L shells are compared with fluxes of more energetic particles in the heart of the outer zone. A number of characteristics of the changes in these fluxes are noted and compared with predictions of several models of particle acceleration and energy transport. It is concluded that two separate mechanisms are required to produce Mev protons in the heart of the outer zone. Protons must first be accelerated to several hundred kilovolts on or above the highest closed drift shells. Several pumping mechanisms which can do this are discussed. Diffusion in which the first adiabatic invariant is conserved can then transport these protons to the heart of the outer zone and further accelerate them to the Mev energy range. A convection system and its associated electric fields contain enough energy to drive the diffusion. Electrons can undergo a similar acceleration process. Author

N70-11281# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.

THE SOLAR PROTON EVENTS OF FEBRUARY, 25 AND 27, 1969. PAPER 1: PARTICLE FLUXES IN INTERPLANETARY SPACE

A. R. Engel, A. Balogh, H. Elliot, R. J. Hynds, and J. J. Quenby [1969] 14 p refs
Avail: CFSTI

Measurements are reported from the HEOS A-1 satellite of the solar proton flux from the flares of February 25 and February 27, 1969. Directional observations were made at > 1 MeV and > 360 MeV and the total flux at intermediate energies was also monitored. The results are consistent with velocity dependent diffusion. A strong backscattering of 360 MeV, but not 1 MeV particles was observed. Author (ESRO)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N70-10030*# National Aeronautics and Space Administration, Washington, D.C.
APOLLO 11: PRELIMINARY SCIENCE REPORT
1969 209 p refs
(NASA-SP-214) Avail: CFSTI CSCL 22A

A preliminary report of the initial scientific observations resulting from the Apollo 11 mission is presented. The scientific objectives, the nature of the lunar surface, the passive seismic experiment, the solar wind composition experiment, the lunar samples, and major findings concerning the samples are discussed. In addition, included are: (1) a photographic summary of the mission, (2) crew observations, (3) a survey of the geologic setting of the lunar samples, and (4) lunar surface closeup stereoscopic photography. F.O.S.

N70-10034 Yale Univ., New Haven, Conn.
DETERMINATION OF THE MASS OF JUPITER FROM A STUDY OF THE MOTION OF (57) MNEMOSYNE
Alan Dale Fiala (Ph.D. Thesis) 1968 190 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-8345

Mnemosyne has now been observed through one period of its long-period inequality since its discovery in 1859. Observations from observatories were collected and reduced to a consistent reference system wherever it was necessary. Visual observations were reduced to the reference system of the FK4 for 1950.0. A definitive set of osculating elliptic elements for the orbit was derived by standard least squares corrections methods, within the framework of a model solar system described by a simultaneous numerical integration of the equations of motion in rectangular coordinates for the principal planets and Mnemosyne. The correction to Jupiter's mass was nearly independent of corrections to other parameters. The correction found using only visual observations agreed with recent results obtained by other investigators. The provisional ratio of the mass of the sum to the mass of Jupiter was 1047.355. The corrected ratio from the visual observations only is 1047.39. The adopted mass ratio is 1047.350 + or - 0.004. Dissert Abstr.

N70-10035 Yale Univ., New Haven, Conn.
THE HELIUM PROBLEM IN COSMOLOGY
George Samuel Greenstein (Ph.D. Thesis) 1968 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No 69-8358

Processes leading to the synthesis of He-4 during the early stages of the expansion of a universe away from a big bang are investigated. Results depend on the chemical potentials of the neutrinos mu sub nu, on the number eta of neutrino types in excess of those already discovered, and on the present averaged-out density of matter in the universe. With mu sub nu and eta small (approximately 0) He-4 abundances by mass of 25%-30% are produced, in excellent agreement with observed values. If mu sub nu or eta differ appreciably from zero either too much or too little He-4 is produced. Nuclear reactions subsequently taking place in stars would not alter the He-4 abundance appreciably. If He-4 is of primordial origin the helium abundances of all stars should be essentially the same. But certain stars in the galactic halo have very small He-4 abundances. It is shown that heavy elements in these stars would diffuse below their photospheres. Dissert. Abstr.

N70-10052 Yale Univ., New Haven, Conn.
TREATMENT OF CLOSE APPROACHES IN STELLAR DYNAMICS
Charles Frederick Peters (Ph.D. Thesis) 1968 97 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-8405

The goal of the present work is the development of a rigorous method of treating binary encounters within a gravitational system of n bodies. The approach is that developed by Levi-Civita to regularize collisions in the restricted problem of three bodies. An analysis of the instability which accompanies binary encounters is presented in terms of the solution to the problem of two bodies in regularized variables. A method is presented for regularizing a binary collision in the three dimensional problem of n bodies using the generalization of Levi-Civita's method by Kustannheimo and Stiefel. Several numerical examples are presented for the planar problem of three bodies and one example involving 25 bodies is given. A method is also presented for the regularization of two or more binary collisions in the problem of n bodies. Dissert. Abstr.

N70-10064 Yale Univ., New Haven, Conn.
A DYNAMICAL DETERMINATION OF THE SOLAR PARALLAX FROM THE MOTION OF (433) EROS
Jay Henry Lieske (Ph.D. Thesis) 1968 182 p refs
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-8381

A precise value of the mass of the earth-moon system relative to that of the Sun, (E+M)/S, is determined from an analysis of the motion of the minor planet (433) Eros. A summary of the work of previous investigators who have analyzed observations of Eros in a determination of the mass of the earth-moon system or one of its related quantities, the astronomical unit in kilometers and the solar parallax, is given. The equations of motion of the nine principal planets and Eros are integrated numerically in rectangular coordinates by the Adams-Stormer method with an N-body computer program. Accurate orbits for the nine principal planets are obtained for the period 1800-2000 from a comparison of the numerically integrated coordinates with those derived from classical astronomical ephemerides. Dissert. Abstr.

N70-10077 Yale Univ., New Haven, Conn.
DETERMINATION OF THE ASTRONOMICAL UNIT FROM HYDROGEN-LINE RADIAL-VELOCITY MEASUREMENTS
Stephen Howard Knowles (Ph.D. Thesis) 1968 155 p refs
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-8375

The scale of the earth's orbit was determined by measuring the radial velocity of a radio wavelength spectral line. The use of 21-centimeter neutral hydrogen absorption features has allowed a determination considerably more accurate than previous experiments using optical-wavelength lines. From a year's series of measurements, the astronomical unit is determined to be 149,588,000 km + or − 10,000 km., in satisfactory agreement with the currently accepted value. Details and limitations of this technique are discussed, and suggestions are made for future extensions. Dissert. Abstr.

N70-10128# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 209 31 Jul. 1969 p 1 ref (See N70-10127 01-34)
Avail: CFSTI

During the period 18-26 June 1968, observations of Icarus, an asteroid that enters the earth's orbit passing close to the surface each 19 years and also approaches to within 28 million km of the sun, were reported in the Crimea using a 50-cm telescope. During this time, the distance to the asteroid increased from 10 to 30 million km, while its brightness changed from the 13th to the 16th stellar magnitude. Knowledge of the orbit of Icarus aids in refining the mass of the planet Mercury and allows further verification of the general theory of relativity. A.C.R.

N70-10156# California Univ., Berkeley. Space Sciences Lab.
EQUIPMENT FOR X-RAY EMISSION OF THE GALACTIC CENTER REGION BY LUNAR OCCULTATION Final Report
C. Stuart Bowyer 4 Jan. 1969 13 p *Its* Ser. 10, Issue 2
(Grant NSF GP-8012)
(PB-184053) Avail: CFSTI CSCL 03B

The objectives of this experimental program fall into the following main categories: To monitor short term variations in the flux of Sco XR-1 and to correlate these variations with variations in the light flux from these sources: To obtain the precise locations and the high energy spectra for known x-ray sources: To scan unusual astronomical objects for evidence of x-ray emission; and To obtain information on the gamma-ray background flux. USGRDR

N70-10158# Royal Greenwich Observatory, Herstmonceux (England).
FIRST GREENWICH CATALOGUE OF STARS FOR 1950-0
London Sci. Res. Council 1969 203 p refs *Its* Roy. Obs. Ann. No. 3
Avail: CFSTI

This catalogue contains the results of the observations of stars made at Greenwich with the Airy Transit Circle from 1931 January 1 to 1940 September 12. The observed right ascension and declination of 1399 fundamental stars are given. These include the 79 azimuth stars and the 219 clock stars, listed with their adopted right ascensions, all Boss P.G.C. stars in the declination zones 0 to +24 deg and +64 to +90 deg, the stars in the Cookson Floating Zenith Telescope programme and the stars north of -15 deg declination contained in the various national ephemerides before the introduction of 'Apparent Places of Fundamental Stars.' All stars of the 'Henry Draper Catalogue' in the declination zone 0 to 24 deg brighter than 8(m)-00 on the Harvard scale are included, except in the hours of right ascension 4, 5, 6, 7, 18 and 19, where no stars fainter than 7(m)-50 have been included. Author

N70-10201 New York Univ., N.Y.
THE STRUCTURE OF THE MARTIAN ATMOSPHERE
Joseph Stephen Hogan (Ph.D. Thesis) 1968 193 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 69-7961

In order to obtain a better understanding of the results of the Mariner 4 occultation experiment, a theoretical study of the structure of the neutral atmosphere and ionosphere on Mars has been made. The distribution of temperature in the lower atmosphere is obtained from a steady state solution of the equation of radiative transfer, allowing for vibrational relaxation of the radiating gas, and for the absorption of solar energy in the atmosphere. Possible relaxation of the vibration-rotation near infrared bands of CO2 in which solar energy is absorbed is considered, and atmospheric transmission functions in the near and far infrared bands of CO2 are calculated using a modified version of the Elsasser band model, taking both Lorentz and Doppler broadening of the spectral lines into account. The required input data are chosen from the most recent estimates of the surface parameters and atmospheric composition available at this time. Dissert. Abstr.

N70-10223# Brigham Young Univ., Provo, Utah. Dept. of Physics.
INTERMEDIATE-BAND AND NARROW-BAND PHOTOMETRY OF STARS Final Report
Delbert H. Mc Namara and H. Kimball Hansen 1969 6 p refs
(Grant NSF GP-5153)
(PB-183999) Avail: CFSTI CSCL 03B

The report summarizes the results obtained from a photometric study of selected objects made with a 24-inch telescope. The titles of the research programs are: intermediate-band photometry of RR Lyrae stars and dwarf Cepheids, metal abundance measurements of eclipsing binaries, photometry of globular star clusters, and photometry of the eclipsing stars RZ Scuti and ZZ Bootis. USGRDR

N70-10237# Virginia Univ., Charlottesville.
OBSERVATIONS OF THE 21-cm LINE TOWARD HIGH-LATITUDE STARS Final Report
[1969] 9 p refs
(Grant NSF GP-7803)
(PB-183997) Avail: CFSTI CSCL 03B

The paper contains reports on the following: twenty-one centimeter observations toward high-latitude stars, motions of high-latitude clouds, frequency dependence of polarization of pulsar CP 0328, construction of a twenty-one centimeter telescope, study of limited aperture synthesis, observations of sources near the north celestial pole at 2295 Mhz and study of clustering of radio sources at meter wavelengths. USGRDR

N70-10246# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 206 13 Jun. 1969 p 1-3 refs (see N70-10245 01-34)
Avail: CFSTI

Abstracts of the following publications are presented: (1) cosmic dust in the galaxy, (2) physical effects of close encounters of galaxies, and (3) structure of diamond-graphite aggregates in meteorites-ureilites in relation to their origin. The characteristics and distribution of cosmic dust in the Galaxy is reviewed. It is thought that the cosmic dust is concentrated in a narrow region on both sides of the galactic equator. F.O.S.

N70-10365*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COLLECTIVE MOTIONS OF A ONE-DIMENSIONAL SELF-GRAVITATING SYSTEM
Frank Hohl and Janet W. Campbell Washington Nov. 1969 27 p refs
(NASA-TN-D-5540; L-6846) Avail: CFSTI CSCL 03A

A one dimensional computer model for a collisionless, selfgravitating system is used to investigate the mixing phase during which a stellar system approaches a quasi-equilibrium state. The results of the calculations are compared with the theory of the mixing phase proposed by Lynden-Bell. Previous investigations have shown that for simple initial conditions, the quasi-equilibrium state which is reached after several crossing times is close to the distribution predicted by Lynden-Bell. In the present paper, more complicated initial conditions are used to test the Lynden-Bell theory. For most systems investigated, the final state is close to the Lynden-Bell distribution. One exception is noted. Author

N70-10387# La Plata Univ. (Argentina).
ANALOG SIMULATOR FOR FLIGHT STABILITY [ESTABILIDAD EN VUELO POR SIMULACION ANALOGA]
A. Hajduk and Carlos A. Zottig 1968 66 p In Spanish *Its* Publ. No. 93
Avail: CFSTI

The determination of the trajectory of a missile and the analysis of its flight by electronic simulations is discussed in terms of the basic theoretical and practical applications. The linear equations of motion are derived, and their solution by analogic computation is presented. The dynamic response to guidance signals of the system in flight are analyzed, and the optimization of the parameters for the automatic control of the simulator are considered. Transl. by F.O.S.

N70-10458 Yale Univ., New Haven, Conn.
VALIDITY OF HANSEN'S METHOD OF PARTIAL ANOMALIES
Paul Edward Nacozy (Ph.D. Thesis) 1968 173 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-8396

Presented is an application of the method to Comet Encke as perturbed by the earth so as to complete Hansen's numerical example and to present a definitive numerical proof of the method. The orbital system of Comet Encke and the Earth, having two near intersections with minimum distances of nearly 0.2 a.u., an eccentricity of the comet of 0.84, and a near commensurability, provides a stringent test of the method. The validity and accuracy of the method is ascertained by comparing the resulting general perturbations with a numerical integration, extending through 15 revolutions of the comet, a time span of 50 years. It is shown that the perturbations obtained from the method are smoothly continuous at the joining points, including the points joining successive revolutions. Dissert. Abstr.

N70-10460*# Bellcomm, Inc., Washington, D.C.
GENERAL CIRCULATION IN THE ATMOSPHERE OF VENUS DRIVEN BY POLAR AND DIURNAL VARIATIONS OF SURFACE TEMPERATURE
I. O. Bohachevsky and T. T. J. Yeh 10 Jul. 1969 34 p refs
(Contract NASw-417)
(NASA-CR-106579; TR-69-103-7-2) Avail: CFSTI CSCL 03B

A three-dimensional model is developed for the representation of circulation in the Venusian atmosphere that includes the effects of both polar cooling and diurnal temperature variation due to the apparent motion of the Sun. The description of the dynamics of the circulation is based on the Boussinesq approximation for a compressible fluid and an analytic expression describing the flow pattern is obtained. The results show that the mean atmospheric motions are essentially meridional, except in a narrow belt near the equator, at a latitude of about 10 deg, where the direction changes abruptly to zonal. The flow pattern is not symmetrical and rotates about the polar axis of Venus with the period of the Venusian day. Author

N70-10461*# Bellcomm, Inc., Washington, D.C.
DIFFERENCES BETWEEN PROPOSED APOLLO SITES. FAR INFRARED EMISSIVITY EVIDENCE
A. F. H. Goetz and L. A. Soderblom (Calif. Inst. of Tech.) 9 Jun. 1969 13 p refs
(Contract NASw-417; Grant NGL-02-002-003)
(NASA-CR-106584; TR-69-340-2) Avail: CFSTI CSCL 03B

Infrared emissivity comparison spectra of nine areas on the lunar surface, each 40 km in diameter, indicate that the majority of the lunar surface, including the five prime Apollo sites, has a constant Si:O ratio so far as present infrared techniques are able to detect. However, an anomaly in the 8–9 mu region of the emissivity spectrum of the crater Plato is interpreted as evidence of significantly different Si:O ratio in the mineral assemblage exposed on that surface. Author

N70-10467*# Bellcomm, Inc., Washington, D.C.
GLEP SITE SELECTION SUBGROUP, FOURTH MEETING, JUNE 17, 1969
N. W. Hinners 4 Aug. 1969 16 p
(Contract NASw-417)
(NASA-CR-106586) Avail: CFSTI CSCL 03B

Participants at the meeting considered various locations of the lunar topography for proposed site mission assignments of ten lunar landings and also made recommendations regarding the Surveyor III as second mission landing site. Tables with selected prime mission landing sites and their science alternates are included. G.G.

N70-10509*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ESTIMATION OF THE LENGTH AND ORIENTATION OF THE LINE BETWEEN TWO CLOSELY CO-ORBITING SATELLITES
John Hrastar Oct. 1969 8 p refs
(NASA-TM-X-6372; X-732-69-439) Avail: CFSTI CSCL 22C

The problem of estimating the baseline length and orientation using a combination of on-board sensor data and processed ground tracking data is considered. A minimum number (3) of simple on-board sensors are assumed. Some of the variables are assumed to be estimated from ground tracking information only. These estimates become part of the observations, along with the on-board sensor outputs, for estimation of the remaining variables. A linear estimate of the remaining variables is derived via a Kalman filter. This sequential processing obviates the need for the simultaneous processing of ground track and on-board data. The importance of deciding which variables are to be estimated from the ground and which are to be estimated using the combined data is discussed. An example demonstrates that baseline length and orientation can be estimated within a few feet and fractions of a degree. Author

N70-10510*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A METHOD USED FOR THE DETERMINATION OF THE EXPLORER 26 SPIN AXIS POSITION
P. A. Bracken, L. R. Davis, and R. W. Janetzke Oct. 1969 50 p refs
(NASA-TM-X-63724; X-612-69-446) Avail: CFSTI CSCL 22C

Two series of least squares fits were performed to determine the Explorer 26 spin axis position in celestial coordinates throughout orbits 1 to 533. The data input to the calculations consisted of the sun's position, Jensen–Cain magnetic field positions, the sun-spin axis angle, values of the magnetic field-spin axis angle and values of the angle between the spin-sun and the spin-field planes. The latter three angles were derived from the on-board solar aspect detector and from the roll modulated output curve of the ion and electron particle experiment. The results of the fits are presented as a table listing a spin axis right ascension-declination pair along with the uncertainties in these angles for each orbit through orbit 533. Author

N70-10511*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR ACTIVITY AND THE GREAT RED SPOT OF JUPITER
V. K. Balasubrahmanyan and D. Venkatesan Oct. 1969 12 p refs Submitted for publication
(Grant NRC A-3685)
(NASA-TM-X-63726; X-611-69-464) Avail: CFSTI CSCL 03A

A search for possible solar Jovian relationship was made using the darkness parameter of the Great Red Spot of Jupiter, over the period 1891–1967. In common with other solar terrestrial phenomena, on the average, a characteristic double maxima in the changes in the parameter during the eleven year solar cycle was observed. Author

N70-10542*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NON-LINEAR LIMB DARKENING FOR EARLY TYPE STARS
D. A. Klinglesmith and S. Sobieski Oct. 1969 11 p refs
(NASA-TM-X-63727; X-613-69-465) Avail: CFSTI CSCL 03B

A set of coefficients has been obtained by fitting an empirical nonlinear limb darkening law to values of the emergent intensity function ratio computed from a grid of hydrogen line blanketed model atmospheres. A set of coefficients for the conventional linear law has also been calculated. The comparison with previous theoretical values for the linearized law shows good agreement with Grygar's results but systematically smaller values than those found by Hosokawn. Author

N70-10611# Picatinny Arsenal, Dover, N.J.
PM-4SS: TWO DEGREE OF FREEDOM MISSILE TRAJECTORY COMPUTER PROGRAM WITH VARIABLE ATMOSPHERE AND OPTION OF SPIN AND STABILITY CALCULATIONS FOR UP TO FOUR STAGE SPIN-STABILIZED MISSILES OR SHELLS USING A SPHERICAL EARTH MODEL
Leonard S. Goldsmith and Richard Beck Jul. 1969 267 p refs
(AD-692305; PA-TM-1636) Avail: CFSTI CSCL 16/2

The report describes a four stage, point-mass trajectory FORTRAN IV program for the IBM 360/65. A fixed spherical earth model is used and the 1959 ARDC Standard Atmosphere is included in the program. Spin calculations and gyroscopic and dynamic stability calculations can be performed. A third order Runge-Kutta method is used for integrating the equations of motion.
Author (TAB)

N70-10613*# Martin Marietta Corp., Denver, Colo.
STATISTICAL TRAJECTORY ESTIMATION PROGRAMS. VOLUME 2: UTILIZATION REPORT
William E. Wagner and Arno C. Serold Jun. 1969 283 p refs
(Contract NAS1-8500)
(NASA-CR-66837) Avail: CFSTI CSCL 22C

This volume documents the computer program logic, subroutine arrangement, input and output formats, and other information concerning the Statistical Trajectory Estimation Programs (STEP) of interest to the user and programmer. STEP uses the recursive Kalman minimum variance filtering algorithms to fit the equations of motion to trajectory measurement data. The programs are formulated to process position radar tracking and airborne gyro and accelerometer measurements. The equations of motion account for three dimensional trajectories in the vicinity of an oblate rotating planet. Vehicle maneuvers in pitch, roll, and yaw within the atmosphere are acceptable. STEP 1 is restricted to nonthrusting vehicles; STEP 2 is applicable to any vehicle recording accelerations and inertial angular rates and having at least partial radar coverage. In addition to postflight reconstruction, the programs are useful for solving preflight trajectory simulation and error analysis problems.
Author

N70-10615*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTEGRATION OF THE RELATIVISTIC EQUATIONS OF MOTION OF AN ARTIFICIAL EARTH SATELLITE
Abolghassem Ghaffari Sep. 1969 19 p refs
(NASA-TM-X-63721; X-551-69-419) Avail: CFSTI CSCL 22C

The Lindstedt perturbation method is applied to the motion of an artificial earth satellite which moves along a geodesic of the Schwarzschild metric of general relativity. The purpose is to determine the extent to which general relativistic effects are detectable in range measurements of earth orbiting spacecraft.
Author

N70-10657# Joint Publications Appropriations Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 204 14 May 1969 p 1–8 refs (See N70-10656 01-34)
Avail: CFSTI

The development of a television telescope for viewing celestial bodies in visible and invisible light is reported, and an integrating microphotometer used to determine stellar magnitudes or integral magnitudes of galaxies from photographs is described. Brief summaries are also included of scientific articles on stellar luminosity, magnitudes, and radiation emission; hydrogen emission from the lower chromosphere; and geological and morphological features of Mars shown on Mariner 4 photographs.
A.C.R.

N70-10661# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, No. 204 14 May 1969 p 58–74 refs (See N70-10656 01-34)
Avail: CFSTI

A brief review of Soviet space achievements is given, including manned space missions, interplanetary probes, and the improved services provided by meteorological, geodetic, and communication satellites. Satellite-based experiments dealing with terrestrial magnetism and upper atmospheric composition, as well as interplanetary magnetic fields, magnetic storms, and cosmic radiation, are also briefly summarized.
A.C.R.

N70-10674*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE MOTION OF A CHARGED SATELLITE IN THE EARTH'S MAGNETIC FIELD
L. Sehnal 5 Jun. 1969 21 p refs Revised
(Grant NGR-09-015-002)
(NASA-CR-106659; SAO SPECIAL Rept-271) Avail: CFSTI CSCL 22C

The perturbations of the orbital elements of a charged artificial earth satellite caused by the earth's magnetic field are studied. A rough estimate of the size of the disturbing effects gives them a very small value. A detailed computation is made in the case of the changes of the inclination of the satellite's orbit.
Author

N70-10691*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VARIATION OF PARAMETERS FOR LONG PERIODIC TERMS IN PREDICTING LIFETIMES OF VENUS ORBITERS
Bernard Kaufman Sep. 1969 36 p refs
(NASA-TM-X-63731; X-551-69-395) Avail: CFSTI CSCL 22C

A very rapid variation of parameters method has been programmed to determine lifetimes of satellites in orbit about Venus. The perturbing function contains only the gravitational potential of the sun. The solar potential is expanded in a trigonometric series and then averaged over not only the period of the satellite but also over the period of Venus. The equation for variation of eccentricity uses only the singly averaged function so as to include medium period effects, however, for inclination and argument of pericenter the doubly averaged function is used. It appears from the results of several sample cases that not only is this method considerably faster than a numerical integration solution of the three body problem but is also highly accurate. Although this method contains only third body terms it should be very useful in first approximation studies.
Author

N70-10698# Dunsink Observatory, Dublin (Ireland).
REDUCED COUNTS OF GALAXIES ALONG GALACTIC COORDINATES
T. Kiang 1968 24 p ref *Its* Ser. C, Dunsink Obs. Publ., Vol. 1, No. 5, p 109–132
Avail: CFSTI

The counts of galaxies per square degree was corrected for all known errors, and then selected to fill preassigned, approximately square, cells along the galactic coordinates; they are shown in Table A. These numbers should be multiplied by a factor of 1.076 to restore the observed level. Average per square degree numbers, averaged over one degree-latitude strips and over approximately six degree-squares are given in Table 3 and Figures 1–2 respectively.
Author

N70-10781*# California Univ., Berkeley. Space Sciences Lab.
CORONAL STRUCTURE AT THE SOLAR ECLIPSE OF SEPTEMBER 22, 1968: PREDICTION AND OBSERVATION
Kenneth H. Schatten 14 Feb. 1969 7 p ref Submitted for publication *Its* Ser. 10, Issue 4
(Grants NSG-243; NGR-05-003-230; Contract Nonr-3656(26); Grant NSF GA-1319; Proj. NR-021-101)
(NASA-CR-106619) Avail: CFSTI CSCL 04A

The coronal structure to be expected during the solar eclipse of 22 September 1968 was published in Nature. A sketch was made available that was prepared from photographs obtained during this eclipse. Many of the features seen in the eclipse (streamers, open-rayed configurations, and condensations) were in good qualitative agreement with those predicted from the model. Comparisons of the exact shape of many features may lead to improvements in the model and to a better understanding of coronal processes. Author

N70-10841# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
THE MAIN PROBLEM OF SATELLITE THEORY FOR SMALL ECCENTRICITIES
Andre Deprit and Rom Arnold Aug. 1969 70 p refs *Its* Mathematical Note No. 615
(AD-692617; D1-82-0888) Avail: CFSTI CSCL 22/3

Perturbation techniques based on Lie transforms as suggested by Deprit were used as the theoretical foundation for programming the analytical solution of the Main Problem in Satellite Theory (all gravitational harmonics being zero except J2). The collection of formulas necessary and sufficient to construct an ephemeris is given. Short and long period displacements, as well as the secular terms, have been obtained up to the third order in J2 as power series of the eccentricity. They result from two successive completely canonical transformations which it has been found convenient not to compose into a unique transformation. Division by the eccentricity appears nowhere in the developments--neither explicitly nor implicitly. The determination of the constants of motion from the initial conditions has been given an elementary solution that is both complete and explicit without being iterative. Author (TAB)

N70-10890 National Lending Library for Science and Technology, Boston Spa (England).
ON THE SEPARATION OF COMPONENTS OF THE NIGHT SKY CONTINUUM [O RAZDELENII SOSTAVLYAYUSHCHIKH KONTINUUMA NOCHNOGO NEBA]
A. V. Migulin [1969] 10 p refs Transl. into ENGLISH from Russian j.
(NLL-RTS-5083) Avail: Natl. Lending Library, Boston Spa, Engl.: 15s

Photoelectric spectrometer recorded curves of the sky nightglow spectrum are analyzed for their continuum components and their spectral distributions. The applied method is based on plotting a Bouger line based on the logarithm of a special source, equal to 100 stars 10 to the mth power per 1 sq. degree, as a function of air mass and determined by the zenith angle of observation of this source. The method of least squares is used to plot two values for the spatial source and to determine the coefficients of transmission. In further processing the starlight component of the continuum is deducted and data corrected for absorption. Results show that the energy distribution in the total continuum does not remain constant in time and space. G.G.

N70-10971# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
RAPID CONTRACTION OF PROTOSTARS TO THE STAGE OF QUASI-HYDROSTATIC EQUILIBRIUM. PART 2: 10, 100, 1000 AND 10000 SOLAR MASSES WITHOUT RADIATION FLOW
Takenori Nakano, Noboru Ohyama (Shizuoka Univ.), and Chushiro Hayashi Oct. 1969 40 p refs
(RIFP-94-Pt-2) Avail: CFSTI

The collapse of opaque protostars of 10, 100, 1000, and 10,000 solar masses is computed up to the onset stage of quasi-hydrostatic equilibrium. The protostars are assumed to retain spherical symmetry, and the dissipation of mass motion energy by shock waves is taken into account. It is found that mass ejected from the surface by the shock wave is negligibly small for the protostars of 1 and 10 solar masses, while it amounts to 10 or 15 percent of the total mass for the protostars of 100, 1000, and 10,000 solar masses. The structure of the stars of 1 and 10 solar masses at the onset stage of quasi-hydrostatic equilibrium is found to be homologous. Author

N70-11010# Royal Aircraft Establishment, Farnborough (England).
AVERAGE ROTATIONAL SPEED OF THE UPPER ATMOSPHERE FROM CHANGES IN SATELLITE ORBITS
D. G. King-Hele Jun. 1969 25 p refs Presented at the COSPAR Symp. on Thermospheric Properties, Prague, May 1969
(RAE-TR-69121) Avail: CFSTI

The average angular velocity of the upper atmosphere can be determined by analyzing the small changes in the orbital inclinations of satellites. This paper reviews the results so far obtained, which indicate that the atmosphere at heights between 200 and 400 km rotates, on average, rather faster than the earth: the excess speed is about 10 % at a height of 200 km, increasing to nearly 50 % at 350 km, and this west-to-east rotation appears to be particularly strong at times after sunset (19h to 21h local time). The results apply to latitudes between 0 and 45 deg. Possible objections to these results are discussed and answered. Comparisons are made with a theoretical model and with experimental measurements of local wind speeds. It is concluded that the results from all these sources are consistent. Author (ESRO)

N70-11018*# Gruman Aircraft Engineering Corp., Bethpage, N.Y.
GROUND BASED PHOTOMETRY OF POTENTIAL NAVIGATION GUIDE STARS
L. L. Smith and H. C. Courten Nov. 1968 18 p
(Contract NAS5-9166)
(NASA-CR-106708; RM-430) Avail: CFSTI CSCL 03A

Photoelectric observations of bright stars were made using the Lunar and Planetary Laboratory 21-inch telescope and a calibrated 1P21 phototube, unfiltered. The magnitude observed is designated [m(S-4)] to indicate that an (S-4) photosurface was used. Calibration curves of [m(S-4) - V] versus (B-V) were derived separately for the supergiant, giant, and subgiant stars, where B and V are the blue and visual photoelectric magnitudes. The curves for the supergiants and giants in the region $+0.1 < (B-V) < +1.2$ are similar and quite linear, while they differ by increment [m(S-4) - V] approximately 0.15 mag for $-0.3 < (B-V) < +0.1$. Theoretical investigations show that the (S-4) magnitude of a given star will vary for different IP21 phototubes. It is concluded that calibration curves must be derived separately for stars of different luminosity classes for each detector system of interest. A preliminary investigation has confirmed the validity of both the m[S-4] computer program and the OAO-A2 guide star list. Author

N70-11027*# National Aeronautics and Space Administration, Washington, D.C.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Semiannual Report to Congress, 1 Jan. – 30 Jun. 1967
7 Oct. 1967 277 p refs
(NASA-TM-X-61982; SAR-17) Avail: CFSTI CSCL 22A

This period involved intensive development efforts for Apollo

spacecraft and Saturn 5 launch vehicle. A fire during the ground test of this spacecraft claimed the lives of three astronauts. The Gemini program was closed out. A thorough investigation of the accident and the steps that were initiated to improve safety by changes in design and procedures have been made. Progress in aeronautics and space flights was evidenced by successful flights of Surveyor, Lunar Orbiter, and many other spacecraft. Author

N70-11029*# National Aeronautics and Space Administration, Washington, D.C.
SIXTEENTH SEMIANNUAL REPORT TO CONGRESS, 1 JULY–31 DECEMBER 1966
7 Oct. 1968 291 p
(NASA-TM-X-61983; SAR-16) Avail: SOD $1.50; CFSTI CSCL 22A

During the period July through December, 1966, the Gemini program was brought to a successful conclusion with the Gemini 10, 11 and 12 flights. Nineteen American astronauts completed sixteen manned space flights and logged almost 2000 hours in space. Experiments performed covered extravehicular activities, rendezvous, and docking maneuvers. Lunar Orbiters transmitted thousands of clear pictures of the moon and the orbiting Intelsat 2 extended the network of commercial communications satellites and linked Hawaii with the continental United States. The first Applications Technology Satellite carried advanced meteorological and communications experiments into orbit. G.G.

N70-11030*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
LONG RANGE PLANNING FOR SOLAR SYSTEM EXPLORATION Quarterly Report, 1 May–1 Aug. 1969
Aug. 1969 39 p
(Contract NASw-1837)
(NASA-CR-106732; IITRI-V6092-3) Avail: CFSTI CSCL 03B

Reported is the study of spacecraft radar systems and Jupiter moon landing missions for the solar system exploration program. Available radar systems, their specifications and limitations, are evaluated, and scaling laws for weight and power requirements of radar obtained. Radar studies for solar system exploration goals are defined and limitations of the present systems are clarified. The effects of planetary characteristics on measurements made by orbiting spacecraft are being analyzed for Mars and procedures are outlined which provide possible methods to determine orbits based on instrument requirements and the various orbit/planetary relationships. Supporting trajector mechanics for a revised Jupiter orbiter mission plan are outlined and mission design points, each embracing a specific launch vehicle, injected payload, and typical planetary transfer characteristics are shown graphically The Halley rendezvous analysis for the nuclear-electric flight mode continued and a multiple-impulse trajectory program for this study was rewritten. A potentially good Jupiter assisted mission to Comet D'Arrest in 1982 has been found. G.G.

N70-11042*# National Aeronautics and Space Administration, Washington, D.C.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Semiannual Report to Congress, 1 Jul.–31 Dec. 1967
7 Oct. 1967 280 p refs
(NASA-TM-X-61981; SAR-18) Avail: CFSTI CSCL 22A

During this reporting period the successful first unmanned flight test of the Apollo Saturn 5 space vehicle was a key milestone in the Apollo Program. Emphasis continued on technical and engineering improvements following the Apollo 204 accident. Planning continued for the follow-on Apollo Applications Program. The pace of lunar mapping and research was accelerated as orbiting spacecraft photographed the Moon and others landed to analyze its surface. Author

N70-11165# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
PERIODIC ORBITS EMANATING FROM A RESONANT EQUILIBRIUM
Jacques Henrard Jun. 1969 57 p refs /ts Mathematical Note-610
(AD-691914; D1-82-0874) Avail: CFSTI CSCL 3/3

For a conservative Hamiltonian system with two degrees of freedom, in the case where the two frequencies at an equilibrium of the elliptic type are commensurable or close to being so, completely canonical transformations can be formally constructed in explicit terms under the form of Lie transforms to the effect that it renders one angle coordinate ignorable and gives to the transformed Hamiltonian the form of what Garfinkel calls an ideal problem of resonance. For the problem so reduced, the unnormalized residual being omitted, natural families of periodic orbits are analyzed, their emergence from the equilibrium is discussed as well as their characteristic exponents. Special attention is given to the evolution of the system of natural families under a continuous transition through the resonance band. Author (TAB)

N70-11182*# Martin Marietta Corp., Denver, Colo.
UTILIZATION REPORT ON STATISTICAL TRAJECTORY ESTIMATION PROGRAMS
William E. Wagner and Arno C. Serold [1968] 282 p refs
(Contract NAS1-8500)
(NASA-CR-66837) Avail: CFSTI CSCL 22C

Information pertinent to the user and programer are presented. Descriptions are given of the input and output, checkout procedures, program logic, FORTRAN symbols, flow diagrams, and listings. Author

N70-11211# General Electric Co., Philadelphia, Pa., Space Systems Div.
CONSIDERATIONS IN CHOOSING THE ORBIT FOR AN EARTH RESOURCES SURVEY SATELLITE
Joseph Otterman and Bruce T. Bachofer 1969 9 p refs Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14–25 Jul. 1969
Avail: CFSTI

The orbit elements required for the ERTS e.g. altitude, eccentricity and inclination are discussed. The geological emission requires recognition of surface features, which are enhanced by shadows produced by moderate to low sun elevation angles. On the other hand the agricultural mission is best achieved with imagery produced under high solar angles. These opposing requirements are discussed in detail along with cloud cover statistics, soil surface temperatures etc. and it is concluded that satellites in mid-morning orbits with descending mode operation or mid-afternoon orbits with ascending-mode operaton will give the most useful results. ESRO

N70-11348# Mitre Corp., Bedford, Mass.
TRACE-D USERS' MANUAL
S. G. Santarelli Jul. 1969 199 p refs
(Contract F19628-68-C-0365)
(AD-692112; MTR-839; ESD-TR-69-273) Avail: CFSTI CSCL 22/3

The report describes the MITRE version of the TRACE-D program now in operation. While the primary function of TRACE-D is orbit determination, options are also available in the program for trajectory prediction and observational data generation. A functional description of these features is contained in this report along with a complete users manual and a brief program description. Author (TAB)

N70-11359# Belgian Royal Observatory, Uccle.
THE CHARACTERISTICS OF AN UNSEEN OBJECT PERTURBING THE MOVEMENT OF A STAR [ETUDE DES CARACTERISTIQUES D'UN CORPS INVISIBLE PERTURBANT LE MOUVEMENT D'UNE ETOILE]
J. Dommanget 1969 16 p refs In FRENCH *Its* Commun., Ser. B, No. 37
Avail: CFSTI

A general approach to the case of a brilliant, invisible companion object perturbing the linear or orbital movement of a star is established. Calculations of the total mass of the system and the apparent magnitude of the companion are based on classical formulations which are photographically verifiable. Three hypotheses are suggested for analyzing the characteristics of the object perturbing the relative movements in a visible couple to determine the physical characteristics of each member. The validity of the first hypothesis on a perturbing body having the characteristics of a planet is demonstrated in an application to known stellar characteristics of the double star 70 Ophiuchi. In the case of a perturbing star which is in a double physical system, only a general solution can be obtained. Transl. by M.H.E.

N70-11388# Oldham (Max S.), McLean, Va.
A PARAMETRIC STUDY OF LOW ALTITUDE ORBITAL FLIGHT
Max S. Oldham [1969] 40 p Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14–25 Jul. 1969
Avail: CFSTI

The report furnishes approximate values for orbital parameters of short-lived, low-altitude, earth satellites. The input or controllable variables include altitude, angle of inclination, angle between the orbital plane and the earth-sun line, orbital eccentricity, position of perigee, sensor angle, and angular resolution. The output or resultant variables include orbital spacing, number of days for complete coverage, swath width, size of ground-information cells, and data rate. Among the assumptions used are that: satellites have no atmospheric drag (nor other degrading factors); there is no orbital precession; and, with respect to swath width, the earth is considered to be flat. Other simplifying assumptions are noted on appropriate charts. The information contained in the charts should serve to isolate parametric values which can then be used to establish feasibility or general usefulness of particular combinations, but most important, can serve as a starting point for more detailed and accurate computations for the planning of specific orbits. The information developed should be applicable to any sensor whose characteristics can be reduced to three: angular access, angular resolution, and data rate. Author (ESRO)

N70-11398# California Inst. of Tech., Pasadena.
THE NATURE OF THE FAR INFRARED RADIATION OF THE GALACTIC CENTER (7)
James Lequeux 1969 15 p refs *Its* Observations of the Owens Valley Radio Obs.
(Contract N00014-67-A-0094)
(AD-693052) Avail: CFSTI CSCL 3/2

The strong far-infrared emission discovered at the galactic center by Hoffmann and Frederick (1968) is shown to be probably emission by dust particles; the large total mass of these particles suggests that the mass of the interstellar medium at the center of the Galaxy may be larger than indicated by the 21 cm line observations. Author (TAB)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N70-10029*# Federal Electric Corp., Houston, Tex.
PROBABILITY OF EOSS MISSION SURVIVAL EVALUATION OF THE IMPACT OF ARTIFICIAL-GRAVITY OPERATIONS ON THE OVERALL MISSION RELIABILITY Preliminary Report
M. J. Seebach 1 Mar. 1968 25 p refs
(Contract NAS8-20412)
(NASA-CR-102291; AS-S-16-68) Avail: CFSTI CSCL 22B

This analysis evaluated both qualitatively and quantitatively the effects on overall Early Orbital Space Station mission reliability of having artificial-gravity operations performed as part of the mission. The additional hardware and operations required for the artificial-gravity mode results in a reduction in overall EOSS reliability of approximately 1.0 percent. Artificial-gravity operations results in additions and changes to the following systems which degrade the overall reliability of the space station and/or degrade their operation: (1) electrical power system, (2) reaction control system, (3) stabilization and control system, (4) communication and data management system, (5) structural and mechanical system, (6) environmental control life support system, and (7) crew systems. It is recommended that analyses be performed as soon as possible to determine the impact of artificial-gravity operations on safety, escape, failure detection, and EVA operations. Author

N70-10047*# North American Rockwell Corp., Downey, Calif. Space Div.
SPACE STATION PROGRAM, PHASE B, DEFINITION STUDY PLAN
R. E. Greer, E. H. Munsey et al 1 Oct. 1969 248 p Revised
(Contract NAS9-9953)
(NASA-CR-101983; SD-69-609) Avail: CFSTI CSCL 22B

The plan is divided into four sections. The first, management structure and functions, establishes the organization structure, the functions of key personnel, and the subcontractor structure. It also expands on the engineering organization and identifies the coordination interfaces between NASA and NR. The second section, task plans, provides the study work breakdown structure that relates to the contract statement of work, identification of functional work packages and their applicability to each element of the work breakdown structure, and the organizational responsibility for each of the work packages. A matrix is presented which displays the monthly distribution of contract manpower to the work breakdown structure by organization. Also included in this section are the six study area flow networks which also show the interaction between the important events and milestones in the program. These networks are plotted in calendar time and include identification of subordinate activities and major milestones or products. Following each net are sub-task summary sheets describing network activities, milestones, and functional code/time support increments. The third section presents the overall master program schedule. Author

N70-10121*# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
LM-8 BPA TEST AND CHECKOUT REQUIREMENTS
Raymond F. Bries 2 Dec. 1968 115 p
(Contract NAS9-1100)
(NASA-CR-106581; LPL-561-8) Avail: CFSTI CSCL 22B

The LM-8 vehicle functions to be tested from build-up to delivery to Cape Kennedy are listed. Test requirements are listed

by subsystem, and the test location is identified in which these requirements are satisfied. Kennedy Space Center requirements are included as a general classification. Descriptions of the plugs-in system verification test and plugs-out mission simulation test are narrated. General ground rules are listed for spacecraft or hardware verification in the event of test invalidation due to spacecraft equipment removal, cable disconnections, and repair. General test and safety requirements for vehicle testing are given. A matrix of systems required in support of vehicle subsystem testing is provided. R.B.

N70-10215*# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
LM-8 BPA FACTORY TEST AND CHECKOUT PLAN
8 Nov. 1968 439 p refs
(Contract NAS9-1100)
(NASA-CR-106578; LTP-561-8) Avail: CFSTI CSCL 22B

The factory test program for the LM-8 vehicle is described from manufacturing buildup to preparation for shipment. Detailed tests for verifying vehicle acceptance requirements are given in outline form. The LM ascent and descent stage flight structures individually undergo a manufacturing buildup phase in which secondary structure and bracketry, complete fluid systems (except for engines), and electrical harnesses are installed. After rotation and cleaning the stages are transferred to the cold flow facility for high pressure fluid systems testing and orifice sizing. Both stages are then transferred to the final assembly area, where the engines are installed, the stages mated, and the LM Combined Subsystem Pre-FEAT tests performed. A second series of fluid systems confidence tests are performed, the stages are rotated and cleaned, the landing gear is installed and checked out, and the stages are mated in preparation for FEAT (Formal Engineering Acceptance Tests). Upon completion of FEAT, ascent and descent stage weight and center of gravity checks are performed. R.B.

N70-10224*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER VENUS/MERCURY 1973 STUDY
Philip K. Eckmann and Charles W. Cole 1 Aug. 1969 144 p refs
(Contract NAS7-100)
(NASA-CR-106557; JPL-TM-33-434) Avail: CFSTI CSCL 22B

A "baseline" mission and spacecraft for a 1973 Mariner Venus/Mercury flyby is described. Many deviations from the baseline mission, such as the Mercury arrival date, aiming point, and encounter geometry are possible, and some alternatives are described. Certain alternative spacecraft mechanizations and subsystem designs are also considered. R.B.

N70-10242*# Wyle Labs., Inc., Huntsville, Ala. Research Div.
PRELIMINARY CRITERIA FOR INTERNAL ACOUSTIC ENVIRONMENTS OF ORBITING SPACE STATIONS
L. C. Sutherland and Elizabeth Cuadra May 1969 34 p refs
(Contract NAS8-21260)
(NASA-CR-102289; TM-69-2) Avail: CFSTI CSCL 22B

Preliminary criteria are proposed for maximum desirable, and, where appropriate, minimum, ambient noise levels inside manned orbiting space stations. A general approach has been used to estimate desired acoustic levels considering: criteria for allowable interference due to noise, the level of interference produced by noise, the type of activity involved and the type of inhabited zones inside an orbiting space station. Every effort has been made to utilize available and applicable information on the effects of acoustic environments on man in this unique situation. Although acoustic criteria can be defined with reasonable accuracy based on interference with speech, the longer-range and more subjective effects of annoyance levels in a shirt-sleeve environment for a "captive" crew become difficult to assess. The criteria proposed, therefore, are preliminary only and subject to validation under conditions representative of space travel. Author

N70-10254# Radio and Space Research Station, Slough (England).
KINETHEODOLITE OBSERVATIONS OF SATELLITES RECEIVED BY THE SATELLITE ORBITS GROUP FROM MALTA FOR MARCH 1968, PART 4
1969 63 p *Its* 1969 Issue No. 4
Avail: CFSTI

Tracking observations were made on the following satellites and rockets: Ariel 3 satellite, Cosmos 185 satellite, Cosmos 196 satellite, Cosmos 203 rocket and satellite, Cosmos 204 rocket, Cosmos 206 rocket and satellite, Cosmos 207 satellite, and Cosmos 209 satellite. The duration of the observations, azimuth, and elevation are reported. M.H.E.

N70-10383# Library of Congress, Washington, D.C. Aerospace Technology Div.
SOVIET DISCUSSIONS OF SPACE-FLIGHT PROBLEMS
Victor Klein and Leonas Kacinskas *In its* Foreign Sci. Bull., vol. 5, no. 10 Oct. 1969 p 1–14 refs (See N70-10382 01-34)
Avail: Issuing Activity

Information is given on the solution of problems associated with the exploration of outer space. The areas discussed are space flights and their trajectories; space-vehicle control during these flights, including rendezvous with space stations, atmospheric entry, and planet landing; and protection of spacecraft against meteorite damage. Author

N70-10483# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
PROPOSED PRELAUNCH REAL-TIME IMPACT PREDICTION SYSTEM FOR THE AEROBEE-350 ROCKET
Edward D'Arcy and Henry Rachele Army Electron. Command May 1969 47 p refs
(AD-692297; ECOM-5250) Avail: CFSTI CSCL 19/4

An improved automatic data collection and processing system is described for use in prelaunch impact prediction of the high-altitude highly wind-sensitive Aerobee-350 rocket. The major components include a 500-foot wind tower, three T-9 radars for tracking pilot balloons (pibals) and FPS/16s for upper wind measurements. The system is an outgrowth of a previous program incorporating recent knowledge of wind measurement techniques, ballistic model refinements, state-of-the art electronic equipment for wind measurement and the use of complex high speed computer programs during countdown operations. New data processing techniques include improved data editing procedures, new numerical pibal wind computation techniques and new techniques for upper air wind measurement. Finally, a faster launcher setting determination method and a shorter operational countdown period were developed. Author (TAB)

N70-10617# Lockheed Missiles and Space Co., Palo Alto, Calif.
SCIENCE EXTENDS THE HORIZON: OBSERVATORY IN SPACE
A. Efremov et al 1969 4 p Transl. into ENGLISH from Pravda (Moscow), no. 297(18710), 24 Oct. 1969
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The Cosmos 262 satellite was launched to test the feasibility of an orbiting astronomical observatory to study ultraviolet and X-radiation in space. The satellite was equipped with multichannel photometers to monitor radiation from the sun, the stars, the interstellar medium, and from the upper atmosphere of the earth. A spectrometer was also included to investigate the solar radiation spectrum. The emission level of the chromospheric hydrogen line was quite low. However, periods of very hard, high intensity radiation were recorded, which are assumed to be related to location of the observatory in the inner regions of the earth's radiation belts. Final analysis of the data recorded depends on determination of the orientation of the observatory. R.B.

N70-10630*# Boeing Co., Huntsville, Ala. Huntsville Operation.
COST STUDIES OF MULTIPURPOSE LARGE LAUNCH VEHICLES. VOLUME 8: FLIGHT CONTROL AND SEPARATION AND STRESS ANALYSIS (UNCLASSIFIED APPENDICES) Final Report
Charles J. Corso 15 Sep. 1969 363 p refs
(Contract NAS2-5056)
(NASA-CR-73335; D5-13463-8) Avail: CFSTI CSCL 22B

This volume presents those unclassified appendices including flight control and separation analysis and stress analysis. The MLLV family will consist of a single-stage-to-orbit configuration plus other configurations consisting of a main stage (as used for the single-stage-to-orbit configuration) with various quantities of 260 inch diameter solid rocket motor (SRM) strap-on stages and/or injection stage modules. The main stage will employ LOX/LH2 propellant with either a multichamber/plug or toroidal/aerospike engine system. The single-stage-to-orbit configuration will have a payload capability of approximately 500,000 pounds to a 100 nautical mile earth orbit. With the addition of the strap-on SRM stages and/or LOX/LH2 injection stage modules, this payload capability can be increased incrementally to as much as 1,850,000 pounds. Author

N70-10549# Radio and Space Research Station, Slough (England).
KINETHEODOLITE OBSERVATIONS OF SATELLITES RECEIVED BY THE SATELLITE ORBITS GROUP FROM MALTA FOR MARCH 1968, PART 1
1969 85 p *Its* 1969 Issue No. 4
Avail: CFSTI

Orbiting objects observed during March 1968 by the Malta satellite tracking station are listed. Oribital parameters are given for the Echo-1, Ariel-1, Injun-3, Thor Agena D, Dash-2, Polyot 1, and Explorer 19 satellites. R.B.

N70-10569*# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
LM-5 BPA FACTORY OPERATIONS TEST PLAN
26 Aug. 1968 280 p refs
(Contract NAS9-1100)
(NASA-CR-106587; LTP-561-5) Avail: CFSTI CSCL 22B

This document describes the factory test program for the LM-5 vehicle. In order to verify that the vehicle and its subsystems satisfy the test program requirements and are in a condition for acceptance, a series of detailed tests are performed. These tests are identified as operational checkout procedures (OCP's). Standard manufacturing procedures (SMP's) are included to identify their scope within the test program. Author

N70-10642# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
LM-6 BPA FACTORY TEST AND CHECKOUT PLAN
16 Sep. 1968 441 p
(Contract NAS9-1100)
(NASA-CR-106561; LTP-561-6) Avail: CFSTI CSCL 22B

This document describes the factory test program for the LM-6 vehicle. In order to verify that the vehicle and its subsystems satisfy the test program requirements and are in a condition for acceptance by NASA, a series of detailed tests are performed. These tests are identified as operational checkout procedures (OCP's). Standard manufacturing procedures (SMP's) are included to identify their scope within the test program. Author

N70-10643*# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
LM-7 BPA FACTORY TEST AND CHECKOUT PLAN
10 Oct. 1968 403 p
(Contract NAS9-1100)
(NASA-CR-106562; LTP-561-7) Avail: CFSTI CSCL 22B

This document describes the factory test program for the LM-7 vehicle. In order to verify that the vehicle and its subsystems satisfy the test program requirements and are in condition for acceptance by NASA, a series of detailed tests are performed. These tests are identified as operational checkout procedures (OCP's). Standard manufacturing procedures (SMP's) are included to identify their scope within the test program. Author

N70-10731*# Bellcomm, Inc., Washington, D.C.
THE POINTING ACCURACY OF AN ORBITING GIMBAL MOUNTED TELESCOPE
P. G. Smith 17 Feb. 1969 58 p refs
(Contract NASw-417)
(NASA-CR-106643; TM-69-1022-2) Avail: CFSTI CSCL 22B

The pointing accuracy obtainable with a control system of the type used on the Apollo Telescope Mount (ATM) is studied. It is shown that the current ATM design has a pointing error of less than 0.1 seconds of arc in the presence of crew motion and that the bulk of this error is due to so-called breakout torque in the gimbal torquers. Means are discussed for reducing breakout torque and other sources of error to the extent that pointing errors not exceeding .01 arc seconds are attainable with an ATM type system. Thus, such a system would meet the pointing requirements of a large (1 meter) diffraction-limited stellar telescope. Results are obtained with the aid of two mathematical models that compute the telescope attitude response to crew motion disturbances, the latter being represented in terms of single motion force and moment time histories applied to specific spacecraft locations; one of the models affords a simplified understanding of the error-producing phenomena, whereas the other model provides for three-dimensional, flexible body dynamics. Author

N70-10798*# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
LM-7 BPA TEST AND CHECKOUT REQUIREMENTS DOCUMENT
21 Aug. 1968 106 p
(Contract NAS9-1100)
(NASA-CR-106642; LPL-561-7) Avail: CFSTI CSCL 22B

The test and acceptance check lists for the LM-7 to be performed from construction to delivery to Cape Kennedy are given. The systems checklists are for: structural mechanical, electrical power, environmental control, guidance and navigation, rendezvous radar, landing radar, stabilization and control, reaction control, propulsion, explosive derices, communications, instrumentation, and crew provisions. The verification and retest philosophy are also detailed in checklist format. F.O.S.

N70-10815# Sandia Corp., Albuquerque, N. Mex.
AEROBALLISTIC, PERFORMANCE, WIND EFFECTS, AND IMPACT DISPERSION ANALYSES, AND FLIGHT TEST DATA FOR THE TWO-STAGE TERRIER (BT-3)-SANDHAWK ROCKET SYSTEM
Gerald G. Wilson Jul. 1969 166 p refs
(PB-185363; SC-DR-69-304) Avail: CFSTI CSCL 19G

The two-stage Advanced Terrier (BT-3)-Sandhawk is a solid propellant, unguided rocket system capable of carrying a 200-pound payload to 1,400,000 feet. A 13-inch diameter ogive-cylinder has sufficient volume for a variety of rocket launched experiments. This report includes aerodynamic, performance, and flight test data, together with the results of wind effect and dispersion analyses. Author (USGRDR)

N70-10849*# TRW Systems Group, Redondo Beach, Calif.
LOW COST LAUNCH VEHICLE STUDY Final Technical Report
J. B. Kendrick 23 May 1969 431 p refs
(Contract NASw-1794)

(NASA-CR-106662; TRW-11851-6008-R000) Avail: CFSTI CSCL 22B

Low cost launch vehicles (LCVL) with the capability for placing payloads of 40,000 to 100,000 lbs into low earth orbits in the 1973 to 1985 period are studied. Five variations of the 3-stage, pressure fed, nonmodular design are investigated. It was found that for 100 launchings, all contenders have a total cost of plus or minus 10 percent from a mean value, and the proposed LCVL offers promise of credible operation at less than one-fourth the cost of current LV's. The most significant results of the study are considered to be: the potential cost savings by adopting the LCVL, and improved management policies; and additional savings by practicing a new discipline in low cost spacecraft design. F.O.S.

N70-10952# Politecnico di Milano (Italy).
POSSIBILITIES OF EMPLOYING ARTIFICIAL SATELLITES IN ITALY FOR FOREST FIRE DETECTION AND WARNING
Raffaello Bruno (Dept. of Agr. and Forestry, Rome) and Umberto Ghezzi [1969] 7 p
Avail: CFSTI

There is a high frequency of forest fires in Italy and they need to be detected in their early stages. The possibility of such detection and signalling by artificial satellites is examined and the necessary detectors, altitudes, speeds and cost are discussed. ESRO

N70-10981*# Boeing Co., Huntsville, Ala. Aerospace Group.
COST STUDIES OF MULTIPURPOSE LARGE LAUNCH VEHICLES, VOLUME 4 Final Report
C. A. Pender, J. Lee, and W. Richard 15 Sep. 1969 1231 p
(Contract NAS2-5056)
(NASA-CR-73331; D5-13463-4) Avail: CFSTI

CONTENTS:

1. BASELINE AMLLV COSTS: GET READY OR A COSTS, BOOK A Final Report C. A. Pender, J. Lee, and W. Richard p 1–358 (See N70-10982 01-31)
2. BASELINE AMLLV COSTS: DEVELOPMENT OR B COSTS, BOOK B Final Report C. A. Pender, J. Lee, and W. Richard p 359–634 (See N70-10983 01-31)
3. BASELINE AMLLV COSTS: OPERATIONAL OR C COSTS, BOOK C Final Report C. A. Pender, J. Lee, and W. Richard p 635–1201 (See N70-10084 01-31)

N70-10982*# Boeing Co., Huntsville, Ala. Aerospace Group.
BASELINE AMLLV COSTS: GET READY OR A COSTS, BOOK A Final Report
C. A. Pender, J. Lee, and W. Richard *In its* Cost Studies of Multipurpose Large Launch Vehicles, Vol. 4 15 Sep. 1969 p 1–358 (See N70-10981 01-31)
(Contract NAS2-5056)
D5-13463-4-Bk-A) Avail: CFSTI CSCL 22B

The detailed cost analysis of the Advanced Multipurpose Large Launch Vehicle (AMLLV) baseline vehicle family is given. Presented are the recurring and nonrecurring costs for implementation and launching of the AMLLV. Cost distributions are shown by program or stage elements, labor, material, tooling facilities, and equipment. Cost summary tables are included. F.O.S.

N70-10983*# Boeing Co., Huntsville, Ala. Aerospace Group.
BASELINE AMLLV COSTS: DEVELOPMENTAL OR B COSTS, BOOK B Final Report
C. A. Pender, J. Lee, and W. Richard *In its* Cost Studies of Multipurpose Large Launch Vehicles, Vol. 4 15 Sep. 1969 p 359–634 (See N70-10981 01-31)
(Contract NAS2-5056)
D5-13463-4-Bk-B) Avail: CFSTI

A detailed breakdown of the total nonrecurring development testing costs for the various configuration elements of the Advanced Multipurpose Large Launch Vehicle is presented. The costs are categorized as follows: single stage to orbit vehicle, injection stage engine module, injection stage fuel module, and solid rocket motor stage. Author

N70-10984*# Boeing Co., Huntsville, Ala. Aerospace Group.
BASELINE AMLLV COSTS: OPERATIONAL OR C COSTS, BOOK C Final Report
C. A. Pender, J. Lee, and W. Richard *In its* Cost Studies of Multipurpose Large Launch Vehicles, Vol. 4 15 Sep. 1969 p 635–1201 (See N70-10981 01-31)
(Contract NAS2-5056)
D5-13463-4-Bk-C)

A detailed breakdown of the total recurring cost for the first unit of the configuration elements of the Advanced Multipurpose Large Launch Vehicle is presented. The recurring costs are categorized as: single stage vehicle, one module injection stage, delta costs for one, fixed costs, and variable costs. The format for displaying cost information for each component is divided into four parts as follows: (1) program management, program planning and reporting, and industrial relations; (2) engineering, production, tooling, and manufacturing test; (3) facilities; and (4) logistics. Author

N70-11050# Joint Publications Research Service, Washington, D.C.
STATUS AND FUTURE OF ORBITAL STATIONS
A. Vasilyev 26 Oct. 1969 6 p Transl. into ENGLISH from Kryl'ya Rodiny (Moscow), no. 8, Aug. 1969 p 21–22
(JPRS-49151) Avail: CFSTI

The 'Soyuz-4' and 'Soyuz-5' spacecraft are described as the world's first manned orbital space stations. Docking of the manned spacecraft was preceded by automatic approach and docking of the 'Cosmos-186' and 'Cosmos-188' and the 'Cosmos-212' and 'Cosmos-213' satellites. Soyuz-4 and Soyuz-5 were launched one day apart. Initial approach maneuvers were controlled automatically by on-board computers of both spacecraft. After closing to a distance of 100 meters, the final approach and docking were controlled by the pilot of Soyuz-4. The experiments completed by the crews of the two spacecraft indicate that orbital stations can be utilized for exploitation of all aspects of earth resources, weather monitoring and forecasting, astronomical observations, and as launch pads for interplanetary flights. R.B.

N70-11112# General Electric Co., Philadelphia, Pa. Space Systems Div.
PROBLEMS IN PHOTOMETRIC ANALYSIS OF IMAGERY FROM SATELLITES
Joseph Otterman 1969 6 p refs Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14–25 Jul. 1969
Avail: CFSTI

The earth resources technology satellites A and B will carry return beam vidicons and line scanners in order to compare the reflectances, from forests and agricultural crops, in various lands in the visible and infrared parts of the spectrum. The problems of image registration, signal-to-noise ratios and atmospheric scattering are discussed and diffraction effects and spectral resolution problems arising from extended circular sources are analysed in detail. ESRO

N70-11128*# Boeing Co., Huntsville, Ala. Aerospace Group.
COST STUDIES OF MULTIPURPOSE LARGE LAUNCH VEHICLES, VOLUME 5 Final Report
C. A. Pender, J. Lee, and W. Richard 15 Sep. 1969 1264 p
(Contract NAS2-5056)
(NASA-CR-73332; D5-13463-5) Avail: CFSTI CSCL 22B

CONTENTS:

1. BASELINE MLLV COSTS: GET READY OR A COSTS, BOOK A Final Report C. A. Pender, J. Lee, and W. Richard p 1–366 (See N70-11127 01-31)

2. BASELINE MLLV COSTS: DEVELOPMENTAL OR B COSTS, BOOK B Final Report C. A. Pender, J. Lee and W. Richard p 367–638 (See N70-11128 01-31)

3. BASELINE MLLV COSTS: OPERATIONAL OR C COSTS, BOOK C Final Report C. A. Pender, J. Lee and W. Richard p 639–1219 (See N70-11129 01-31)

N70-11127*# Boeing Co., Huntsville, Ala. Aerospace Group.
BASELINE MLLV COSTS: GET READY OR A COSTS, BOOK A Final Report
C. A. Pender, J. Lee, and W. Richard *In its* Cost Studies of Multipurpose Large Launch Vehicles, Vol. 5 15 Sep. 1969 p 1–366 (See N70-11126 01-31)
(Contract NAS2-5056)
(D5-13463-5-Bk-A) Avail: CFSTI CSCL 22B

An analysis of the nonrecurring costs is presented. These costs are the get ready costs, or A costs which are associated with getting ready to produce, and operate the first production article. Tables of cost summaries are included. F.O.S.

N70-11128*# Boeing Co., Huntsville, Ala. Aerospace Group.
BASELINE MLLV COSTS: DEVELOPMENTAL OR B COSTS, BOOK B Final Report
C. A. Pender, J. Lee, and W. Richard *In its* Cost Studies of Multipurpose Large Launch Vehicles, Vol. 5 15 Sep. 1969 p 367–638 (See N70-11126 01-31)
(Contract NAS2-5056)
(D5-13463-5-Bk-B) Avail: CFSTI CSCL 22B

The nonrecurring development and testing costs, or B costs, are analyzed. Tables of cost summaries are included. F.O.S.

N70-11129*# Boeing Co., Huntsville, Ala. Aerospace Group.
BASELINE MLLV COSTS: OPERATIONAL OR C COSTS, BOOK C Final Report
C. A. Pender, J. Lee, and W. Richard *In its* Cost Studies of Multipurpose Large Launch Vehicles, Vol. 5 15 Sep. 1969 p 639–1219 (See N70-11169 01-31)
(Contract NAS2-5056)
(D5-13463-5-Bk-C) Avail: CFSTI CSCL 22B

A detailed breakdown of the total recurring cost for the first unit of the configuration elements of the MLLV is presented. The modularized data provides an understanding of the costs associated with hardware production, and utilization through launch and evaluates the relative impact of specific items. The costs for each stage represent the total cost for production and launch of that configuration element for a single-stage-to-orbit vehicle. Tables of cost summaries are included. Author

N70-11158*# Grumman Aircraft Engineering Corp., Bethpage, N.Y.
LM-10 BPA TEST AND CHECKOUT REQUIREMENTS DOCUMENT
Raymond F. Bries 4 Mar. 1969 111 p
(Contract NAS9-1100)
(NASA-CR-106559; LPL-561-10) Avail: CFSTI CSCL 22B

Test and checkout requirements list LM-10 vehicle functions to be tested at the factory from build-up to delivery to Cape Kennedy. Test requirements are listed by subsystems and contain descriptions of the plug-in verification test, the plug-out mission simulation test, ground rules for spacecraft or hardware verification tests after cable disconnections, repair, etc., as well as general and safety test requirements. G.G.

N70-11168*# North American Rockwell Corp., Downey, Calif.
SPACECRAFT Patent Application
Earl M. Van Alstyne, inventor (to NASA) Filed 15 Aug. 1969 11 p
(NASA-Case-MSC-13047-1; US-Patent-Appl-SN-850586) Avail: CFSTI CSCL 22B

Details are given on a spacecraft with an aerodynamic outer shell which acts as the heat shield. It includes an excursion module removably housed within the shell, with the module having a retracted landing gear and a forward thrusting means, such as an engine, at the forward end and a crew station generally rearward of the landing gear. It also includes means for separating the module from the shell after separation, whereby the spacecraft can then be landed by activation of the thrust means to land the vehicle forward end down. NASA

N70-11180*# Mississippi State Univ., State College. Dept. of Electrical Engineering.
A STUDY OF THE EFFECTS OF VARYING THE SAMPLING FOR A SIMPLIFIED VERSION OF THE SATURN V/S-1C Final Report, 15 May 1968–31 Aug. 1969
Jerry R. Mitchell and Willie L. McDaniel 31 Aug. 1969 156 p
(Contract NAS8-21377)
(NASA-CR-102303) Avail: CFSTI CSCL 22B

The bending frequencies of a large space vehicle, such as the Saturn V/S-1C, can be detrimental to the stability of the system. A scheme for filtering the bending frequencies from the control information is to keep the same relative stable position between the bending mode z-plane poles and corresponding compensation zeros. The effects of varying the sampling period on a reduced order Saturn V/S-1C is presented for several flight times. Included are open and closed loop studies when sampling period is varied and a typical compensation of the system. Conclusions regarding these are also presented. Author

N70-11183# General Electric Co., Philadelphia, Pa. Space Systems Div.
EARTH RESOURCES SATELLITE SYSTEMS
David W. Keller 1969 17 p Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14–25 Jul. 1969
Avail: CFSTI

The capabilities of the return beam vidicon cameras and link scanners designed for the earth resources technology satellites A and B are described. The analysis of sensor performance and the choice of a 496 n.m. sun synchronous orbit with an inclination of 99.04 deg are discussed and short accounts of the wideband communication system and the handling of data at the rate of 10 to the 10th power bits per orbit are given. ESRO

N70-11238# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
TELEVISION SYSTEMS FOR EARTH RESOURCES SATELLITE
Herbert M. Gurk 1969 23 p refs Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14–25 Jul. 1969
Avail: CFSTI

This paper summarizes all aspects of television system usage for Earth Resources Technology Satellites (ERTS). It describes various ERTS television camera configurations, the characteristics of the return-beam vidicon camera, and devices to reproduce the television pictures on film on the ground. In addition, the other requirements for a ground data handling system for these pictures and an initial ground system concept are developed, the image processing requirements for various applications are described, and finally, the future of television for remote sensing is discussed. Author (ESRO)

N70-11273# Radio Corp. of America, Princeton, N.J. Astro-Electonics Div.
THE TIROS M SATELLITE IN AN ERTS ROLE
C. R. Hume 1969 9 p Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl. 14–25 Jul. 1969
Avail: CFSTI

Some earth resources technology satellites are needed in which any likely payload can be integrated. The current configuration and subsystems of the TIROS 13 satellite are examined in the light of this requirement and its growth capabilities are outlined. ESRO

N70-11274# LTV Aerospace Corp., Dallas, Tex. Missiles and Space Div.
SMALL PAYLOAD POTENTIAL FOR EARTH RESOURCES
Alfred I. Sibila 1969 45 p refs Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14–25 Jul. 1969
Avail: CFSTI

Utilization of small payloads can play a significant role in space orientated assessment of geological, marine, and agricultural wealth and health. This paper reviews the application of small spacecraft to such earth resources survey endeavors. The capability of small boosters, such as the Scout launch vehicle, to place payload weights into circular, elliptical, and low earth orbits is presented. Particular attention is paid to recurring sun-synchronous orbits including the conditions necessary to establish such precise orbits. Typical launch sites available and the earth coverage provided from each are illustrated. The state-of-the-art developments leading to the ability to configure spacecraft to meet the weight and volume limitations of small payloads is explored and illustrated with examples of typical spacecraft designs. Two approaches for small earth resources payloads emerge. One is the systems oriented concept with full capability for orbit correction to accurate sun-synchronous near-recursion orbits. This concept will probably be limited to one or two sensors and would have on-board data storage. The other approach is a simpler concept where orbital accuracy and lighting conditions are traded for greater experiment weight. In keeping with a low-cost approach the data handling for the latter concept centers around real time transmission. Author (ESRO)

N70-11275# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
A REVIEW OF REMOTE EARTH OBSERVATION TECHNOLOGY
R. W. Laing and G. K. C. Pardoe 1969 23 p Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14–25 Jul. 1969
Avail: CFSTI

A brief review of the historical background is followed by descriptions of the various possible instruments and techniques which range from sensors and infrared devices to radar imagery and photography. A summary of achievements with different satellite orbits at various heights is given and the paper concludes with a statement on the present position and the part Europe can play in extending the techniques of remote observation of earth resources. ESRO

N70-11277# International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
ORBITAL IMAGES FOR EARTH RESOURCES SATELLITE MISSION PLANNING
Frank J. Wobber [1969] 31 p refs Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14–25 Jul. 1969
Avail: CFSTI

Imaging systems can be expected to constitute more than 70% of the future data collecting load of earth satellites. The images themselves provide realistic earth resources data and mission guidance preliminary to operational earth resources survey satellites. The value of available orbital images i.e. photographs are considered and priorities for earth orbital applications are accessed. A summary is given of suggested earth resources survey tasks versus parameters, such as angle of view (obliquity) and solar altitude, which can maximize the data collected. ESRO

N70-11291# Royal Aircraft Establishment, Farnborough (England).
TABLE OF EARTH SATELLITES LAUNCHED DURING 1968
D. G. King-Hele, H. Hiller, and J. A. Pilkington (Scarborough Planetarium) May 1969 46 p refs
(RAE-TR-69109) Avail: CFSTI

All known artificial satellites launched between 1 January and 31 December 1968 are listed chronologically. Lifetimes, weights, dimensions and orbital details are given for instrumented satellites and their final-stage rockets. Other fragments are listed without these details. An index is provided, and there is also a complete list of amendments for bringing up-to-date the table of satellites launched in the years 1957 to 1967, which was issued last year. Author (ESRO)

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N70-10032# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
ON THE USE OF FINITE ELEMENTS AND COMPLIANCE CALCULATIONS FOR DETERMINING CRACK TIP STRESS INTENSITY FACTORS
W. R. Andrews and D. F.Mowbray 13 Mar. 1969 13 p refs
(Contract W-31-109-eng-52)
(PB-184350; KAPL-P-3815) Avail: CFSTI CSCL 13M

The potential usefulness of the finite element method of stress analysis in linear fracture mechanics has been demonstrated in a recent paper by Chan, Wilson, and Tuba. These authors determined crack tip stress intensity factors for several standard laboratory test geometries by three methods, all of which involved using the finite element calculated stress and/or displacement fields close to the crack tip with established crack tip relations. In order to achieve satisfactory accuracy with these methods, it was necessary to incorporate in the finite element structural idealization an extremely fine grid near the crack tip. The present authors have carried out a limited study with a finite element computer program utilizing the compliance or strain energy release rate method. USGRDR

N70-10083# Sandia Corp., Livermore, Calif. Applied Mechanics Div.
DETERMINATION OF THE STIFFNESSES OF AN ELASTIC FILLER CONSTRAINED BETWEEN A RIGID SPHERE AND A RIGID ELLIPSOIDAL SHELL
S. S. Chiu Mar. 1969 35 p
(Contract AT(29-1)-789)
(PB-183836; SCL-DR-68-16) Avail: CFSTI CSCL 13I

The report investigates an elastic medium which is constrained within a rigid ellipsoidal shell and which contains a rigid spherical inclusion that is initially concentric with the principal axis of the rigid ellipsoidal shell. The effects of the inclusion's motions, relative to the shell, on the stiffness of the elastic medium are calculated. Spherical and cylindrical outside shells are also considered as limiting cases of the ellipsoid. The results compare favorably with available analytical and experimental data. Author (USGRDR)

N70-10074 Northwestern Univ., Evanston, Ill.
ANALYSIS OF PLATE AND SHELL STRUCTURES BY TRIANGULAR FINITE ELEMENTS
William Ying-Jer Shieh (Ph.D. Thesis) 1968 88 p
Avail: Univ Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-6989

Presented is a triangular element composed of three sub-elements with the use of quadratic displacement functions for the analysis of plate and shell structures by the displacement method. Two stiffness matrices are developed, one for plate bending problems and the other for plane stress problems. The two matrices are superimposed for the analysis of shell structures. The analysis of plate bending problems is based upon a quadratic displacement function which allows the rigid body displacement of the element. Numerical examples are presented to show the accuracy of the results obtained by the proposed element, its adaptability to the solution of plate bending problems which are difficult to treat by other procedures, and the monotonic convergence of the results as the mesh size becomes finer. The method of analysis and the accuracy of the proposed solution are illustrated by the treatment of a continuous prismatic shell. The proposed triangular elements yield satisfactory results for practical purpose using rather coarse mesh size and single precision calculation.
Dissert. Abstr.

N70-10089 Stanford Univ., Calif.
LARGE DISPLACEMENT ANALYSIS OF INELASTIC PLANE FRAMES
Albert William Knott (Ph.D. Thesis) 1968 112 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-8207

A method is presented for the analysis of plane frames exhibiting nonlinear response. Both large displacements and inelastic material behavior are considered. The procedure is based upon the direct stiffness method and consists of a cyclic, step-wise linear solution which traces the load-displacement history of the frame from initial load application to final structural collapse. Collapse is defined as the condition that exists when the structure stiffness matrix becomes singular. The direct stiffness method requires the generation of member stiffness matrices. In addition, the deflected shape of each member is obtained at each step in the solution by determining the response of the assemblage of elements to the current end displacements obtained from the general solution. Dissert. Abstr.

N70-10108 Catholic Univ. of America, Washington, D.C.
BENDING OF QUADRILATERAL ORTHOTROPIC PLATES
Charles Ota Heller (Ph.D. Thesis) 1968 269 p
Avail: Univ. Microfilms: HC $12.15/Microfilm $3.50 Order No. 69-9108

The dissertation is a result of a study of the elastic behavior of flat, orthogonally anisotropic, rectangular and skewed, quadrilateral plates under static lateral loads. Navier-type expressions are developed for rectangular orthotropic plates with various conditions of edge supports and loadings. These equations are converted into rapidly-converging single-series forms and numerical solutions are generated by means of a digital computer. Skewed orthotropic plates are solved using a variational technique which is programmed for digital computation. Numerical results are given. The application of orthotropic plate theory to various types of orthogonally stiffened plates, along with experimental techniques for the determination of elastic constants, is discussed in the dissertation. Finally, a minimum-weight comparison of the relative efficiencies of several rectangular stiffened plates is presented, and a bibliography of work in the area of orthogonally stiffened plates is included. Dissert. Abstr.

N70-10118 Northwestern Univ., Evanston, Ill.
INELASTIC STABILITY OF TAPERED WIDE-FLANGE COLUMNS
Kuang-Huei Lin (Ph.D. Thesis) 1968 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-6957

The stability of symmetrically and linearly tapered wide-flange columns made of elastic-plastic materials and subjected to combined bending and axial loads is investigated. Approximate interaction equations are derived to facilitate the determination of the load carrying capacity of such columns. Assuming an idealized elastic-plastic stress-strain relationship and idealized wide-flange section, three possible types of stress distribution, namely, elastic, primary plastic and secondary plastic, are established. The equations defining the statically admissible domain and the interfaces between different zones of stress distribution are derived. The moment-thrust-curvature relationship for each type of stress distribution is derived in closed form. Elastic and inelastic equilibrium curves for tapered cantilever columns are obtained by numerical integration. A criterion for the snap through type of instability based on these equilibrium curves, is used to construct the interaction curves. Dissert. Abstr.

N70-10214# Technische Hochschule Munchen (West Germany). Fakultaet fuer Bauwesen.
***AN* ELEMENTARY METHOD FOR CALCULATION OF BUCKLING VALUES FOR ORTHOTROPIC AND ISOTROPIC RECTANGULAR PLATES [EIN ELEMENTARER WEG ZUR BERECHNUNG VON BEULWERTEN ORTHOTROPER UND ISOTROPER RECHTECKPLATTEN]**
G. Thierauf (Ph.D. Thesis) Jan. 1969 77 p refs In GERMAN *Its* Mitt. No. 1
Avail: CFSTI

This method is particularly suited for analyzing complicated edge loads. Applications in numerical analyses are demonstrated using some simple load cases for which the exact buckling values are known. For the complicated edge loads, approximate solutions from the work of other investigators are used to compare the results. An advantage of the present method is that the buckling value can be established regardless of the form of the buckled surface (e.g. number of buckles). For the estimation of errors, which presents difficulties when using the energy method, the techniques known from the theory of integral equations can be applied in the present method. A disadvantage is the narrow limitation of the kernel in the integral equation to Navier-type boundary conditions.
Transl. by K.W.

N70-10218 National Lending Library for Science and Technology, Boston Spa (England).
CREEP AND FATIGUE BEHAVIOUR OF THE X 40 CoCrNiW 4520 HIGH TEMPERATURE ALLOY
E. Keil et al 18 Jul. 1969 13 p Transl. into ENGLISH from Material Pruefung (Duesseldorf), v. 10, no. 4, Apr. 1968 p 116-121
(NLL-CE-Trans-5056-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.

Creep and fatigue tests were carried out between 700 C and 900 C and diagrams of ultimate strength and creep limits for lives up to 1000 hours were plotted. The fatigue strength of a smooth bar at low temperatures and short lives is lower than the creep rupture strength but it is much higher at high temperatures and long periods. The alternating stress amplitude of pulsating fatigue strength is equal to the creep rupture strength for high temperatures and long lives. In the case of small and medium superimposed stress amplitudes the life up to the creep limit is only slightly reduced compared with that of pure creep rupture tests. The tests were supplemented by metallographic examinations.
Author

N70-10221# Aeronautical Research Labs., Melbourne (Australia).
FURTHER EVALUATION OF CHROMIUM ALLOY J GUIDE VANES
B. Parmington and H. T. Greenaway Mar. 1969 13 p refs
(ARL/ME-305; ARL/MET-65) Avail: CFSTI

In a cascade designed to simulate gas turbine operating conditions, chromium alloy J guide vanes were exposed for 25 hours in sonic velocity gas stream at metal temperatures of 1200 C and 1300 C. For comparative purposes, two vanes were also tested in an air furnace under the same conditions of time and temperature. It was found that -- (a) The weight loss during the cascade test at 1200 C was in excess of the figure of 0.10 milligram/sq cm/hr which is considered acceptable in the aircraft turbine application. (b) The depth of nitride contamination in vanes heated in the high velocity gas stream varied considerably over the vane profile, but was always less than that obtained in still air tests. This marked difference in the two types of test could not be explained by the metal loss in the cascade test. Author

N70-10225# Technische Hochschule Munchen (West Germany).
INVESTIGATIONS OF HEAVY WELDED FULL-WALL-LENGTH CRANE RUNWAY SUPPORTS [UNTERSUCHUNGEN AN SCHWEREN GESCHWEISSTEN VOLLWANDKRANBAHNTRAEGERN]
Gerhard Maas (Ph.D. Thesis) Mar. 1969 157 p refs In GERMAN
Avail: CFSTI

The geometry and the principles of static calculations of load conditions (primarily in the upper track)in heavy, welded crane runway supports are examined. Stresses in the horizontal and vertical directions of the tracks under static loads are determined on models by means of expansion measurements. The size of the load/contact surfaces between crane wheel and track as well as the stress concentrations are measured on cross sections of the support. Preliminary results are presented of direct load measurements on wheel and track under operational conditions. The formation of cracks in the welds is analyzed in terms of operational strength measurements, constructional design of the crane support, and load distribution in the support. Transl. by K.W.

N70-10230# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME METHODS FOR STUDYING AMPLITUDE-DEPENDENT DISSIPATION OF ENERGY IN A MATERIAL
A. P. Yakovlev *In its* Internal Friction in Metals 31 Jan. 1969 p 7-16 (See N70-10228 01-26)
Avail: CFSTI

A description of 3 experimental apparatus D-3, D-5, and D-7, representing the development degrees of the method of measuring the energy dissipation in a material is mainly conditioned by microplastic deformations. Apparatus D-3 is intended for the damping properties investigation at low temperatures up to -196 deg; D-5 mostly intended for a study of damping properties of materials in flexing vibrations at room and elevated temperatures up to 200 deg. Its advantages are similar to those of D-3. The D-7 is intended for the investigation of the dissipation energy in transverse vibrations in vacuum at room and high temperatures at 1200-1500 deg. The distinct advantage of this apparatus is the feasibility of investigating at high temperatures in a vacuum of 2-5 x 10 (to the minus 5th power) mm., a fact most important in the case of specific infusible materials which at high temperature rapidly become oxidized in open air. This apparatus makes it possible to carry out investigations both at atmospheric pressures and in any medium. Author

N70-10231# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TOWARD THE THEORY OF THERMOELASTIC INTERNAL FRICTION IN A SOLID BODY
Ya. S. Podstrigach et al *In its* Internal Friction in Metals 31 Jan. 1969 p 17-25 refs (See N70-10228 01-26)
Avail: CFSTI

The dissipation of mechanical energy during thermoelastic processes in a finite solid body by means of heat emission through the surface of a solid body into the surrounding medium is discussed. The connection between the equations of thermoelasticity and the rheological relations is established. The internal friction in the solid body, arising as a result of the thermoelastic dissipation is investigated; such internal friction is caused both by heat flow within the solid body as well as through its surface. A math expression for the determination of internal friction of the system studied is derived. The frequency dependence of the wave propagation and of internal friction is discussed. Low frequency waves propagate faster than high-frequency waves in a thermally isolated bar, while just the reverse is true for viscoelastic bars. Author

N70-10243*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A METHOD FOR SOLVING HYPERVELOCITY IMPACT PROBLEMS WITH CONSIDERATION OF FREE-SURFACE DISCONTINUITIES
Richard E. Turner Washington Nov. 1969 33 p refs
(NASA-TN-D-5525) Avail: CFSTI CSCL 20K

A new method of tracking free surfaces has been developed and used to apply boundary conditions along free-surface discontinuities occurring in the motions of compressible media. The stability of the finite-difference equations used to track those free surfaces has been investigated under simplified conditions and the method was found to be stable. Also, finite-difference approximations to the continuity equation and general transport equation (which governs the motions of continuous media, in cylindrical coordinates) have been developed in which convective terms are simplified and motion constants (mass, momentum, and internal energy) are conserved in transit. This system of equations has been applied to the solution of a hypervelocity-impact problem in which an aluminum cylinder with a 10-centimeter base diameter, 8-centimeter top diameter, and 6-centimeter height impacts a 2-centimeter-thick target with a relative velocity of 20 kilometers per second. This solution is compared with an independent solution. Author

N70-10259# Catholic Univ. of America, Washington, D.C. School of Engineering and Architecture.
DEVELOPMENT OF EXPERIMENTAL STRESS ANALYSIS METHODS TO DETERMINE STRESSES AND STRAINS IN SOLID PROPELLANT GRAINS. STRESS DISTRIBUTION AROUND A CIRCULAR BAR, WITH FLAT AND SPHERICAL ENDS, EMBEDDED IN A MATRIX IN A TRIAXIAL STRESS FIELD
V. J. Parks, A. J. Durelli, K. Chandrashekhara, and T. L. Chen Jul. 1969 33 p refs
(Contract Nonr-2249(06))
(AD-691261; Rept-21) Avail: CFSTI CSCL 21/9.2

The report deals with the stress and strain distribution around a circular bar embedded in a matrix and subjected to a mechanically applied triaxial load. The three-dimensional freezing technique of photoelasticity was used. The results obtained correspond to the case of a rigid circular bar embedded in an homogeneous, elastic matrix. Two models were analyzed; in one the axis of the circular bar was parallel to the direction of the loading and in the other the axis of the circular bar was normal to the direction of loading. By combining the results obtained independently for these two cases, stress and strain distribution around the circular bar for various ratios of triaxial load can be obtained. Author (TAB)

N70-10319# Road Research Lab., Crowthorne (England).
SOME EXACT SOLUTIONS FOR THE BENDING OF FLAT PLATES UNDER TRANSVERSE LOADS
C. E. Smith 1969 62 p refs
(PB-184323; RRL-LR244) Avail: CFSTI CSCL 13M

Exact solutions of the differential equation governing the small bending deflections of flat orthotropic plates are presented for a variety of support conditions and loadings. The equations are augmented by tables of dimensionless numerical coefficients, the application of which is illustrated by several worked examples. Author (USGRDR)

N70-10328*# Wyle Labs., Inc., Huntsville, Ala. Research Div.
A MULTIVARIATE INTERPOLATION TECHNIQUE TO PRODUCE THREE-DIMENSIONAL SURFACE PLOTS OF VIBRATING STRUCTURES
D. M. Lister May 1969 42 p refs
(Contract NAS8-21260)
(NASA-CR-102288; WR-69-10) Avail: CFSTI CSCL 20L

A method of multivariate interpolation for the production of a smooth surface which passes exactly through a set of given points in three-dimensional space is discussed. Two methods of projecting this surface onto a plane are developed. A Fortran computer program which employs the above techniques to produce three-dimensional plots of the interpolated surface is described. The utilization of this program to produce mode plots of vibrating structures is indicated. Author

N70-10342# Sandia Corp., Livermore, Calif.
THE ANALYSIS OF IRREGULARLY SHAPED AND STIFFENED PLATE STRUCTURES Development Report
J. L. Keller Jun. 1969 57 p refs
(Contract AT(29-1)-789)
(PB-184637; SCL-DR-69-24) Avail: CFSTI CSCL 13M

The use of plate structures has created a need for a method of analysis which will adequately account for irregular shapes, unsymmetrical loadings, and arbitrary boundary conditions. In many cases, it is also desirable to predict the behavior of a plate structure when stiffened by arbitrarily placed ribs and when discontinuities such as cutouts interrupt the continuity of the plate. This paper describes a numerical procedure which accounts for all the special conditions encountered in real plate structures. Author (USGRDR)

N70-10479 National Lending Library for Science and Technology, Boston Spa (England).
CONCERNING CALCULATION OF THE STABILITY OF CYLINDRICAL BLANKS ON COLD UPSETTING [K RASCHETU USTOYCHIVOSTI TSILINDRICHESKIKH ZAGOTONOK PRI KHOLODNOY VYSADKE]
V. G. Parshin et al May 1969 9 p refs Transl. into ENGLISH from Kuznechno-shtamp Proizv (USSR), no. 11, 1968 p 6–8
(NLL-RTS-5120) Avail: Natl. Lending Library, Boston Spa, Engl.: 7s 6d

Blank stability is defined by the upsetting coefficient: k = 1 sub 0/d sub 0 where 1 sub 0 and d sub 0 are the initial height and diameter of the upset part of the blank. The upsetting coefficient is considered to reach a maximum with the blank in pure shear. The equation for the stability of a blank of work hardening material compressed beyond the elastic limit is given, and it is concluded that: (1) The stability of a blank in cold upsetting, besides depending on the well-known factors, also depends on the type of material and the degree of preliminary work-hardening. (2) Blank stability at the start of the process of cold upsetting can be assessed quantitatively by equations. F.O.S.

N70-10486# Brown Univ., Providence, R.I. Div. of Engineering.
CONSTITUTIVE EQUATIONS FOR ELASTIC-PLASTIC MATERIALS AT FINITE STRAIN
L. B. Freund Mar. 1969 32 p refs
(Contract ARPA SD-86)
(AD-692475; ARPA-E64) Avail: CFSTI CSCL 20/11

Constitutive equations are suggested for describing the behavior of elastic-plastic materials undergoing large strains. A special kinematical viewpoint is taken, so that the elastic and plastic deformation processes can be considered separately. This separation is also accomodated by a simplified thermodynamical theory of the deformation process. The general elastic constitutive equation is written as a rate equation, after examining the interpretation of elastic isotropy in view of the particular kinematical description employed. To describe plastic deformation, a general rate equation, which exhibits no dependence on the rate at which previous states have been traversed, is suggested. After the general relations have been put in appropriate form some simplifications based on physical assumptions are considered. The physical assumptions are based on the behavior of metals under large stress, high speed loading, such as in the penetration problem. Under these operating conditions, the thermoelastic effects dominate and plasticity plays a minor role. Consequently, a simple model of plastic deformation usually suffices. The analysis is presented in direct (matrix) notation and is valid for arbitrary stress states. Author (TAB)

N70-10515*# Bellcomm, Inc., Washington, D.C.
AXISYMMETRIC SHELLS
S. Kaufman 24 Jul. 1969 36 p
(Contract NASw-417)
(NASA-CR-106583; TM-69-2031-3) Avail: CFSTI CSCL 20K

The digital program AXSHEL has been written for the UNIVAC 1108 computer to solve the static response characteristics of axisymmetric shells, specifically the characteristics of the S-2 LOX tank shell. The program solves for influence and stiffness matrices of shells of revolution by a finite element technique. Bending as well as membrane strain energy is included in the formulation. An option to include the effects of differential stiffness (initial internal forces) has been incorporated. Another option of AXSHEL is the solution of internal forces and deflections due to pressure and/or concentrated static loadings. A test run of a spherical cap subjected to an external pressure is included. Comparisons are made to analytic theory. Author

N70-10524# Air Force Systems Command, Wright-Patterson AFB, Ohio.
DELAYED INSTABILITY (BUCKLING) OF VISCOELASTIC MATERIALS
J. C. Halpin and E. A. Meinecke Jul. 1969 19 p refs
(AD-692482; AFML-TR-68-331) Avail: CFSTI CSCL 20/11

Delayed buckling of a viscoelastic material was investigated experimentally as a function of buckling load, time, and temperature. The concept of Reduced Variables was shown, for the first time, to be applicable to this physical phenomenon. Linear viscoelastic analysis was employed to give a qualitative and a semiquantitative description of the buckling process and the prediction of the critical time to buckle. Author (TAB)

N70-10592# National Research Council of Canada, Ottawa (Ontario).
THE FATIGUE STRENGTH OF BUTT-WELDED AND PLAIN SPECIMENS OF 18(250) MARAGING STEEL PLATE
J. A. Dunsby and A. C. Walker May 1969 44 p refs
(NRC-10883) Avail: CFSTI

Fatigue tests are reported for pulsating tension on samples of maraging steel plate, both with and without central transverse butt welds. Tests are also described in which the weld bead was

removed by grinding. The results obtained from the plain plate, which was tested as rolled and aged, were inferior to those reported by other investigators for specimens machined from bar stock. To investigate this discrepancy, plain plate specimens were also tested with the surfaces ground before aging and after aging. Author

N70-10603# Aeronautical Research Labs., Melbourne (Australia).
AXIAL LOAD FATIGUE TESTS ON CHROMIUM-MOLYBDENUM STEEL TUBING WITH WELDED FISH-MOUTH TYPE SPLICES
F. G. Harris and R. W. Rowan Mar. 1969 32 p refs
(ARL/SM-323) Avail: CFSTI

Axial load fatigue tests with various combinations of mean stress and alternating stress, have been carried out on specimens of CrMo alloy steel tubing having welded fish mouth splices typical of aircraft design and manufacturing standards. The type of weld adopted causes a substantial reduction in the fatigue strength, for example at 1,000,000 cycles under fully reversed axial loading conditions, a fatigue ratio of less than 0.1 can be expected. The position of failure in the specimen is influenced by the maximum load of the fatigue cycle. At lower loads, a stress concentrator in the form of a cavity resulting from incomplete penetration of the weld metal causes failure in the larger tubes of the joint. From information available, this defect appears to be inherent in all splices of this particular type. Author

N70-10671# Commissariat à l'Energie Atomique, Bruyères-le-Châtel (France).
GENERAL PHENOMENOLOGY OF UNDERGROUND NUCLEAR EXPLOSIONS [PHENOMENOLOGIE GENERALE DES EXPLOSIONS NUCLEAIRES SOUTERRAINES]
Serge Derlich and Francis Supiot Aug. 1969 35 p refs In FRENCH; ENGLISH summary
(CEA-R-3750) Avail: CFSTI

A qualitative description is given of the phenomena related to underground nuclear explosions (explosion of a single unit, of several units in line and simultaneous explosions). The phenomena which are common to contained explosions and to explosions forming craters are first described. These are the formation and propagation of shock waves causing vaporisation and the fusion and fracturing of the medium. The phenomena related to contained explosions - formation of cavities with chimneys - are then described. The third chapter is devoted to the phenomenology of test explosions which form a crater. It describes in particular the mechanism of formation and the different types of craters as a function of the depth of the explosion and of the nature of the ground. The aerial phenomena connected with explosions which form a crater: shock waves in the air, focusing at large distances and dust clouds are also dealt with. Author (ESRO)

N70-10736# Illinois Univ., Urbana. Dept. of Civil Engineering.
NUMERICAL ANALYSIS OF ELASTIC PLATES AND SHALLOW SHELLS BY AN INTEGRAL EQUATION METHOD
Delroy J. Forbes and Arthur R. Robinson Jul. 1969 245 p refs *Its* Structural Res. Ser. 345
(Contract N00014-67-A-0305)
(AD-691275) Avail: CFSTI CSCL 20/11

A numerical method for the analysis of elastic plates and shallow shells is developed. The static boundary value problems are formulated in terms of integral equations by use of the reciprocal relationships between the actual state of stress and certain singular ones resulting from point loads on a plate. Quadrature techniques are developed to approximate the singular integral equations by a set of algebraic equations in the unknown boundary quantities at selected points. The stress resultants and displacements at interior points are computed directly from the boundary values. Results obtained for several plate and shallow shell problems by the approximate method are in excellent agreement with the exact solutions. Author (TAB)

N70-10747*# United Aircraft Corp., East Hartford, Conn.
SIMPLIFIED PROCEDURES FOR ESTIMATING FLAPWISE BENDING MOMENTS ON HELICOPTER ROTOR BLADES. PART 1: PROCEDURES AND CHARTS
Anton J. Landgrebe Washington NASA Oct. 1969 462 p refs
(Contract NAS1-7880)
(NASA-CR-1440-Pt-1) Avail: CFSTI CSCL 20K

Simplified procedures predict the flapwise bending moments acting on low stiffness articulated and hingeless helicopter rotor blades. Such moments are basically linear functions of several independent rotor parameters and can be computed by transfer function, superposition techniques. Transfer coefficients relating independent rotor parameters to harmonics of moment are derived using a computer analysis which numerically integrates the blade flapwise equation of motion. These coefficients are presented in the form of design charts for a wide range of blade design parameters and operating conditions of interest. Detailed procedures for using the charts are described and illustrated with sample calculations. The accuracy of the method is demonstrated by several comparisons of bending moment (or stresses) computed from the charts with full scale rotor experimental results and with results from a more complete numerical analysis in which chordwise and torsional degrees of freedom are included. A complementary analysis for predicting closed-form, approximate expressions for the transfer coefficients is also developed. Author

N70-10749# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
EFFECTS OF EXTERNAL LOAD ON CAVITATION DAMAGE
Dale J. Kemppainen and Frederick G. Hammitt Mar. 1969 32 p refs Presented at the IAHR Symp., Kyoto, Sep. 1969
(Grant NSF-GK-1889)
(PB-184143; TR-01357-5-T) Avail: CFSTI CSCL 20D

Cavitation damage rates in an ultrasonic cavitation field upon specimens subjected to an externally applied stress are reported. Brass, bronze, aluminum, magnesium, copper, stainless steel and carbon steel were tested in cold water under tensile and compressive stresses of 3/4 of their yield strength, and in one case at twice that value. Damage rates under stress were compared with those for identical specimens under zero load. Generally it was found that compression tends to reduce damage during the constant damage rate portion of the test, while tension increases it. Measurements were also made of the effect of a given cavitation volume loss upon the yield and tensile strength of the specimens. In general it was found that the effect is much greater than that which would be predicted on the basis of an exactly uniform damage distribution across the specimen. Author (USGRDR)

N70-10784# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Flugzeugbau.
ON MAKING FILMS OF BUCKLING AND POST-BUCKLING BEHAVIOR OF THIN-WALLED CIRCULAR CYLINDERS [BERICHT UEBER DAS FILMEN DES BEUL- UND NACHBEULVERHALTENS VON DUENNWANDIGEN KREISZYLINDERN]
Maria Esslinger and Hans-Rainhard Meyer-Piening Jun. 1969 22 p In GERMAN; ENGLISH summary Sponsored by Deut. Forsch. Gemeinschaft
(DLR-MITT-69-07) Avail: CFSTI

The behavior of three isotropic and two orthotropic circular cylinders at the stability limits has been studied with the aid of normal speed and high speed cinematography. The instrumentation used for this purpose, the setting up of the experiment, and some remarks on the technique of filming are the main subject of the present paper. In addition, the contents of the films obtained are briefly described. Author (ESRO)

N70-10828# Commissariat à l'Energie Atomique, Bruyères-le-Châtel (France).
SPECTRAL CONTENT OF SEISMIC MOVEMENTS PRODUCED BY UNDERGROUND NUCLEAR EXPLOSIONS [CONTENU SPECTRAL DES MOUVEMENTS SEISMIQUES DUS AUX EXPLOSIONS NUCLEAIRES SOUTERRAINES]
Agnès Albaret and Francoise Duclaux Jun. 1969 28 p refs In FRENCH; ENGLISH summary
(CEA-R-3767) Avail: CFSTI

After a summary of available data, both theoretical and experimental, concerning the spectral content of seismic movements, a description is given of the experiments carried out during the French nuclear explosions in the Sahara and of the results obtained on the volume waves. A comparison is then made with certain American results. A new method is described for studying the amplitude spectra which has made it possible to show that the amount of low frequencies in the spectrum increases with the power of the explosion and decreases with the distance to the zero point and with the filtering effect of the weathered zone. A calculation is then made of the low cut-off ground of the filter which gives a better representation of the initial seismic phenomenon. Author (ESRO)

N70-10902*# Linde Div., Union Carbide Corp., Huntsville, Ala. Cryogenic Products Dept.
SUPER INSULATION SYSTEMS FOR CRYOGENIC TEST TANK Final Report
C. R. Lindquist 12 Sep. 1969 244 p revised
(Contracts NAS8-11740; NAS8-24567)
(NASA-CR-102319) Avail: CFSTI CSCL 20K

The development of the technology to utilize existing materials for superinsulated space tankage and application to a 105-inch tank are described in detail. Among the more important results are the following findings. A laminate of 1 mil Mylar – 0.8 mil lead – 1 mil Mylar was chosen for the vacuum jacket over the insulation. Satisfactory adhesives are identified as Schjeldahl GT-200 for joints at noncryogenic temperatures, DuPont Adiprene L-100 for joints at cryogenic temperatures, and Armstrong A-12 for repairing minute vacuum leaks. An evacuation time of less than fifty hours to 100 microns Hg was predicted and found experimentally for the 105-inch tank. Each individual radiation shield was made a structural entity by taping it together with adhesive tape. Small scale thermal tests indicated a thermal conductivity of 3.5 x .00001 Btu/hr-ft deg F with a 95-layers/inch density. The insulation system for the 105-inch tank consisted of radiation shields of aluminum foil and spacers of 106 Dexiglas paper. It is concluded that the alternate layer superinsulation is attractive from the thermal performance standpoint. N.E.N.

N70-10972*# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.
EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF THE DUCTILE FRACTURE OF POLYMERS Quarterly Status Report
H. F. Brinson Oct. 1969 11 p refs
(Grant NGR-47-004-051)
(NASA-CR-106739) Avail: CFSTI CSCL 20K

The ductile fracture of polymers was studied both analytically and experimentally to gain some insight into the ductile behavior of polymers, or more particularly, the ductile failure and/or fracture of polymers. Polycarbonate (lexan) was selected for this study because of its unique ductility properties and because its stress – strain behavior is very similar to that of mild-low carbon steel. Other reasons for its selection were its high birefrigence, and because some information about its properties exist in the literature, thus providing a basis of comparison. It was shown that the Dugdale theory of ductile fracture could be applied to polycarbonate. Measurement of plastic zone sizes and crack opening displacements compared favorably with Dugdale's theory. Author

N70-11003# Catholic Univ. of America, Washington, D.C.
RESPONSE OF RATE SENSITIVE FRAMES TO IMPULSIVE LOAD
Nicholas Perrone Jun. 1969 29 p refs
(Grant NSF GK-2082)
(PB-185364; Rept-11) Avail: CFSTI CSCL 13M

The response of frames made of rate-sensitive material and subjected to high intensity loading is determined in an approximate way by using modal approximations and plastic hinges with an effective length of 3 beam depths. An initial modal deformation pattern is assumed and a tentative associated solution obtained. Should the solution turn out not to be valid (or 'safe') a new modal pattern is assumed and the process repeated. The square portal frame under horizontal impulsive impact is treated in detail. The results show that if the impulsive velocity is less than some limiting value, a simple side sway motion is the correct one; if this critical velocity is exceeded the horizontal member bows out due to centrifugal inertia force. Extension of the technique discussed here to account for strain hardening and pressure pulse loading on frames is also considered. Author (USGRDR)

N70-11021# Commissariat à l'Energie Atomique, Bruyères-le-Châtel (France).
THE PHYSICS OF PHENOMENA IN THE ZONE CLOSE TO AN UNDERGROUND NUCLEAR EXPLOSION [PHYSIQUE DES PHENOMENES EN ZONE PROCHE DES EXPLOSIONS NUCLEAIRES SOUTERRAINES]
Jacques Maury and Clet Levret Sep. 1969 45 p refs In FRENCH; ENGLISH summary
(CEA-R-3850) Avail: CFSTI

After a description of the phenomenology of underground explosions, the basic laws governing the ground propagation of the energy produced by the explosion are given. The report considers hydrodynamics, the mechanics of solids, the equations of state for solids and gases in the case of very high and medium pressures and the dynamical strength of solids. These various elements make it possible to draw up a system of equations which define completely the changes with time of the shock-wave produced in the ground by the explosion. Author (ESRO)

N70-11026# North Carolina State Univ., Raleigh. Applied Mathematics Research Group.
THE DETERMINATION OF THE STRESS INTENSITY FACTOR OF A PARTIALLY CLOSED GRIFFITH CRACK
J. Tweed 15 Jul. 1969 22 p refs
(Grant AF-AFOSR-1779-69)
(AD-692532; AFOSR-69-2054-TR) Avail: CFSTI CSCL 20/11

The problem of calculating the stress intensity factor of a Griffith crack in an elastic solid in which body forces are acting was considered recently by Sneddon and Tweed who obtain a solution which remains valid as long as the crack surfaces do not meet other than at the crack tips. It was shown by Burniston however, that by a suitable choice of loading it is possible to cause the crack surfaces to meet in the centre of the crack and this in turn sets up new boundary conditions which make the solution given by Sneddon and Tweed invalid. It is the purpose of this paper to show that Burnistons results may be obtained by the techniques used by Sneddon and Tweed and to generalize these results slightly. Author (TAB)

N70-11039# Naval Civil Engineering Lab., Port Hueneme, Calif.
CYCLIC IMPACT STUDIES IN DYNAMIC PHOTOELASTICITY Final Report, Jul. – Oct. 1968
S. K. Takahashi and R. Mark Jun. 1969 69 p refs
(AD-691252; NCEL-TR-632) Avail: CFSTI CSCL 20/11

A controlled cyclic loading system and stroboscopic light source was selected to analyze the in-plane loading of plates and frames. The controlled cyclic loading system and stroboscopic light source can be used effectively and economically to obtain good

photographs with a conventional camera of dynamic isochromatic patterns in low- and high-modulus plates and frames (except for the high-modulus embedded-polariscope models). Author (TAB)

N70-11055# Lockheed Missiles and Space Co., Palo Alto, Calif.
NATURAL VIBRATIONS OF ORTHOTROPIC SHELLS UNDER THE EFFECT OF HYDROSTATIC PRESSURE AND LONGITUDINAL FORCES
O. N. Ivano [1969] 8 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 10, no. 2, 1964 p 149–157
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Differential equations are constructed for natural oscillations of orthotropic shells subjected to hydrostatic pressure and longitudinal forces. Individual cases are presented for boundary conditions of shells with both edges supported freely, of shells clamped rigidly at the endpoints, and of shells with one end freely supported and the other clamped. R.B.

N70-11058# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE COMPOUND PROBLEM OF STRUCTURAL MECHANICS AND QUESTIONS ON THE CALCULATION OF OPTIMAL SIZE GRID COMBINED SYSTEMS
I. S. Girfanov 7 Mar. 1969 9 p refs Transl. into ENGLISH from Kazan Aviats. Inst. (Kazan), no. 91, 1966 p 78–81
(AD-690238; FTD-HT-23-1205-68) Avail: CFSTI CSCL 13/13

This is a critique of some of L. I. Korshuns interpretations and definitions dealing with the compound problem (of combined systems) in structural mechanics. Author (TAB)

N70-11108*# National Aeronautics and Space Administration. Langley Research Station, Langley Station, Va.
A STRUCTURAL MERIT FUNCTION FOR AERODYNAMIC DECELERATORS
Melvin S. Anderson, Herman L. Bohon, and Martin M. Mikulas, Jr. Washington Nov. 1969 33 p refs
(NASA-TN-D-5535; L-5605) Avail: CFSTI CSCL 20K

Equations for the mass of decelerators based on structural and aerodynamic considerations including the effects of minimum gage material have been derived, and a suitable function representing decelerator efficiency has been identified. Equations for the merit function are presented for subsonic and supersonic parachutes, ballutes, and attached inflatable decelerators (AID). In the subsonic range three types of parachutes are compared and the ringsail was determined to be most efficient. In the supersonic range the ringsail was again most efficient for small sizes or low loading conditions, but the AID showed potential of efficiency comparable to the ringsail for large sizes or high loads. Application of the merit function to determine optimum deployment conditions for a planetary entry mission is also illustrated. Author

N70-11125# Combustion Engineering, Inc., Windsor, Conn. Nuclear Power Dept.
VANADIUM PURIFICATION Quarterly Progress Report, 1 Jul.–30 Sep. 1969
J. C. LaVake and S. S. Christopher Nov. 1969 22 p
(Contract AT(30-1)-3742)
(CEND-3742-344; QPR-8) Avail: CFSTI

The second batch of V-15Cr-5Ti sheet was fabricated, making a total of 45.6 pounds of sheet produced. The alloy ingot for use at Argonne National Laboratory was shipped, completing the material production phase of the program. Tensile testing of the recrystallized sheet is complete along with eight stress rupture tests. The material gives typical curves for time to rupture and minimum creep rate properties. Author (NSA)

N70-11160# Aeronautical Research Labs., Melbourne (Australia).
THE PROGRESSIVE MEASUREMENT OF LOCAL CREEP IN TURBINE BLADES
A. S. Finlay Mar. 1969 32 p refs
(ARL/ME-124) Avail: CFSTI

A method is presented for measuring the local creep strain in turbine blades. This method was successfully used to assess the remaining life of HS31 blades in a turbine, and to select the test temperatures to give a blade life of about 100 hours. Author

N70-11177# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
APPLIED STRESS AND CAVITATION DAMAGE
Dale J. Kemppainen and Frederick G. Hammitt Mar. 1969 10 p refs
(Grant NSF-GK-1889)
(PB-184139; Rept-01357-2-I) Avail: CFSTI CSCL 20D

Tests are described which show that the effects of externally applied stress upon cavitation damage can be quite substantial, particularly (though not exclusively) in the early part of the test. Since these tests were limited to uniaxial applied loads, it may be that two or three dimensional applied stress patterns will show even more dramatic effects. The measurements of the effect on specimen gross strength properties of a given volume removal by cavitation as compared to the nominal area reduction should allow at least an engineering estimate of this effect for different materials and for damage incurred under different conditions of prestress, as would apply in most operating machines. Author (USGRDR)

N70-11242# Technische Hochschule, Darmstadt (West Germany). Fakultät für Bauingenieurwesen.
CALCULATION OF HIGHLY CURVED THIN-WALLED I-BEAMS SUBMITTED TO BENDING AND CAMBER FORCES TAKING INTO ACCOUNT THE CROSS SECTION DEFORMATION [BERECHNUNG DES STARK GEKRUEMMTEN DUENNWANDIGEN I-TRAEGERS AUF BIEGUNG UND WOELBKRAFTTORSION UNTER BERUECKSICHTIGUNG DER QUERSCHNITTSVERFORMUNG]
Harald Friemann (Ph.D. Thesis) 3 Jan. 1968 125 p refs In GERMAN
Avail: CFSTI

Stresses and deformation of curved thin walled I-beams submitted to torsional loads in a direction perpendicular to the plan of curvature of the beam are analyzed. It is shown that the flanges of the beam are subjected to deformation which leads to alteration of the stresses and camber of the rib of the beam. A method of calculating the stresses and deformation is developed. ESRO

N70-11297# Commissariat à l'Energie Atomique, Bruyères-le-Châtel (France).
UNDERGROUND NUCLEAR EXPLOSIONS. GEOLOGICAL SURVEY OF THE CAVITIES [EXPLOSIONS NUCLEAIRES SOUTERRAINES. ETUDE GEOLOGIQUE DES CAVITES]
Jean Faure Jul. 1969 26 p refs In FRENCH; ENGLISH summary
(CEA-R-3779) Avail: CFSTI

A geological survey of underground nuclear explosions makes it possible to determine the main characteristics of the cavity formed. The lower portion is spherical and the same is very likely true of the roof, which collapses in the majority of media with the exception of rocksalt. Its radius, for a given bomb size, can vary by a factor of two according to the type of rock. The lay-out of its contents depends on the characteristics of the solid and liquid products at the moment of the roof's collapse. According to the medium involved, mixing of the rubble and the mud-flow occurs (granite) or does not occur (tuff and alluvia). In all media, the average physical properties can be evaluated. Author (ESRO)

N70-11319 Stanford Univ., Calif.
DISCRETE ELEMENT ANALYSIS OF SHELLS
William Rodney Estock-Taylor (Ph.D. Thesis) 1968 218 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-8173

A procedure for the linearly elastic analysis of thin shells is presented, based on a generalization of the stiffness method. The shell is idealized by an assemblage of discrete elements of rectangular planform, having constant curvature and twist within each element. Evaluation of displacements and stresses within the shell is reduced to the problem of solving a linear system of algebraic equations, in a form ideally suited to implementation on a digital computer. Properties of the discrete element are defined in terms of nodal influence coefficients, developed from a modified Reissner energy functional. This permits independent assumptions on the distributions of displacements and stress resultants within the element, and allows exact satisfaction of stress boundary conditions. The method is discussed in general terms for a plane stress element, and it is shown that in this case use of such a functional may be specialized to yield results identical to those obtained by Pian's method of assumed stress distributions.
Dissert. Abstr.

N70-11342*# Boeing Co., Seattle, Wash. Aerospace Systems Div.
DESIGN AND DEVELOPMENT OF TECHNIQUES FOR FABRICATION OF CRYOGENIC TANK SUPPORT STRUCTURES FOR LONG TERM STORAGE IN SPACE FLIGHTS Final Report
D. H. Bartlett and J. C. Mc Ginnis Jun. 1969 122 p refs
(Contract NAS8-20901)
(NASA-CR-61309; D2-121073-1) Avail: CFSTI CSCL 20L

The investigation described in this report was conducted in two phases. Phase 1 consisted of design and analytical optimization of several conical support structural concepts for the 32 ft. diameter Modular Nuclear Vehicle (MNV) LH2 tank. The concepts were compared on a weight and heat flow basis, and the most promising configuration selected for subscale fabrication in Phase 2. In Phase 2 a 117-inch diameter conical support was fabricated for the MSFC 105-inch LH2 test tank. The part was intended for thermal performance evaluation, therefore the cross section was a full size representation of the MNV conical support design. A trial assembly of the subscale part was made prior to shipment.
Author

N70-11354# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE FLUTTER OF CLAMPED PLATES
Ia. A. Metsaveer 1969 3 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Tverdogo Tela (USSR), no. 4, 1969 p 179–180
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The flutter of a rectangular plate clamped rigidly along the outline and rotated relative to the free stream is investigated by the method of approximate separation of variables. An unexpected result is obtained that the plate stability grows as the angle of rotation relative to the flow increases.
Author

N70-11375# Sandia Corp., Albuquerque, N. Mex.
RANDOM VIBRATION
J. V. Otts Nov. 1968 130 p refs Sponsored by AEC
(PB-184113; SC-TM-68-534) Avail: CFSTI CSCL 20K

The basic purposes of this report are: (1) to provide a reference manual for the test personnel in order to better acquaint them with all phases of random testing, including test design, test setup, test performance, data analysis, and interpretation; (2) to provide those responsible for test specifications with a reference concerning the techniques, capabilities, and limitations of random testing within the laboratory, including standard calculations; and (3) to provide the project and design personnel with an understanding of the data analysis techniques, capabilities, and limitations including examples which show how to modify test data and calculate response characteristics.
Author (USGRDR)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N70-10208# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
REVIEW OF HEAT TRANSFER TO HELIUM 1
R. V. Smith Repr. Proc. of the 1968 Summer Study on Superconducting Devices and Accelerators, Pt. 1, Apr. 1969 p 249–291 refs
(Contract AT(49-2)-1165)
(PB-184222; R-514) Avail: CFSTI CSCL 20M

The purpose of this paper is to collect, compile, and to make useful recommendations on information with respect to heat transfer to helium 1. The collection section of the paper considers all the relevant information with respect to helium heat transfer. This includes not only data on heat transfer coefficients but also appropriate properties data and heat transfer data, from systems using fluids other than helium, that should be useful to this study.
Author (USGRDR)

N70-10238# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMBUSTION AND EXPLOSION PHYSICS Selected Articles
3 Feb. 1969 31 p refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (Novosibirsk), v. 3, no. 1, 1967 p 77–85 and 98–104
(AD-692160; FTD-HT-23-776-68) Avail: CFSTI CSCL 21/2

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1. DETERMINATION OF REACTION RATE CONSTANT FOR THE REACTION OF THE HYDROXYL RADICAL WITH HYDROGEN V. V. Azatyan et al p 1–15 refs (See N70-10239 01-06)

2. KINETIC COMPUTATIONS OF LOW TEMPERATURE FLAMES OF HYDROGEN AND CARBON MONOXIDE V. Ya. Basevich et al p 16–26 refs (See N70-10240 01-33)

N70-10240# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
KINETIC COMPUTATIONS OF LOW TEMPERATURE FLAMES OF HYDROGEN AND CARBON MONOXIDE
V. Ya. Basevich et al *In its* Combust. and Explosion Phys. Feb. 1969 p 16–26 refs (See N70-10238 01-33)
Avail: CFSTI

A study was made to determine the accuracy with which the burning rate in oxygen-hydrogen and oxygen-hydrogen-carbon monoxide flames can be determined at various reactant concentrations and pressures by computer calculations based on elementary reactions rate constants from the literature. It is pointed

out that such calculations are evidently the only suitable method for analysis of complex combustion phenomena, taking into account all the chain reactions in the flame. Hence, the importance of knowing their accuracy. The experiments involved measuring the laminar burning velocity in a spherical bomb with central Agafalon and recording the final temperature in the combustion zone. The equipment and procedure used were described previously by the authors. Author

N70-10241*# Little (Arthur D.), Inc., Cambridge, Mass.
DESIGN STUDY OF PASSIVE DETECTOR COOLING TECHNIQUES Final Report
26 Aug. 1969 363 p refs
(Contract NAS5-21009)
(NASA-CR-108577; C-71494) Avail: CFSTI CSCL 20M

The study begins with a review of existing concepts and designs of radiator systems. The advantages and disadvantages of various approaches are delinated for a system to be utilized on the ATS-F spacecraft configuration. Basic design concepts for passive coolers are then discussed with emphasis on the methodology of shielding and the implications on the surface thermal/optical properties. A separate section deals with the heat inputs to a typical cooler. These include sun and earth heat inputs, ATS-F solar panel and antenna heat inputs, and heat loads associated with the detector subsystem. Analyses are performed to determine the weights and volumes of LCE radiator systems for two spacecraft configurations. Detailed radiation cooler performance calculations are then made for one spacecraft configuration. Results are reported for the temperature-time history over an orbit for three different times of the year. A brief study of test methods applicable to the developmental, qualification, or acceptance level testing for the experiment subsystem is also reported. Author

N70-10340# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
REFRIGERATION AT 4 DEGREES K
T. R. Strobridge 1968 13 p refs Presented at 1968 Summer Study on Superconducting Devices and Accelerators, Upton, N.Y., Apr. 1969 Submitted for publication
(PB-184220; R-511; BNL-50155) Avail: CFSTI CSCL 20M

The paper discusses the refrigeration methods used in the region of 4 degrees K, including evaporting liquid helium baths, the Simon process, the Joule-Thomson, Brayton, Claude, Stirling and Gifford-McMahon cycles. USGRDR

N70-10384*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
MEASUREMENT OF HEAT TRANSFER IN ROCKET ENGINES. PART 2. RESULTS AND COMPARISON WITH THEORETICAL COMPUTATIONS [WAERMEUEBERGANGSMESSUNGEN AN RAKETENTRIEBWERKEN, TEIL 2. MESSERGEBNISSE UND VERGLEICH MIT THEORETISCHEN BERECHNUNGEN]
Eugen Schaeffer (Ph.D. Thesis--Technische Hochschule Stuttgart) Washington NASA Oct. 1969 30 p refs Transl. into ENGLISH from the German Report
(Contract NASw-1692)
(NASA-TT-F-12561) Avail: CFSTI CSCL 21B

Analyses of stationary heat transfer measurements on rocket engines and comparison with theoretical values obtained by approximation methods showed generally good agreement. The only differences were observed in the location of highest heat transfer; measurements placed these values before the nozzle throat whereas the theoretical determined heat transfer maximum was in the nozzle throat. Author

N70-10366*# National Aeronautics and Space Administration, Washington, D.C.
FLIGHT TEST OF HIGH-DENSITY PHENOLIC-NYLON ON A SPACECRAFT LAUNCHED BY THE PACEMAKER VEHICLE SYSTEM
William G. Witte Nov. 1969 53 p refs
(NASA-TM-X-1910; L-6678) Avail: CFSTI CSCL 20M

The recoverable spacecraft was a hemispherically blunted cone with a cylindrical afterbody and an overall length of 29.5 inches and a diameter of 10 inches. Ablation performance data on the phenolic nylon were obtained by the use of ablation sensors and thermocouples and by postflight profile change measurements. Profile change measurements were also obtained for several panels of low density materials attached to the spacecraft cylinder. A comparison of measured heating rates with computed turbulent and laminar heating rates indicated that the boundary layer underwent transition. Author

N70-10451# Bureau of Mines, Washington, D.C.
HEATS OF FORMATION OF THREE OXIDES OF RHENIUM
E. G. King, D. W. Richardson, and R. V. Mrazek Nov. 1969 16 p refs
(BM-RI-7323) Avail: Issuing Activity

Heats of formation of three crystalline oxides of rhenium (ReO_2, ReO_3, and Re_2O_7) were determined by the method of solution calorimetry, using an aqueous perchloric acid–ceric perchlorate solvent. Copper metal and cupric oxide were utilized as auxiliary substances. Heats were determined at 298 deg K for the reactions. Standard heats of formation were derived using the value of -37.23 + or - 0.15 kcal/mole as the heat of formation of CuO. The standard molal heats of formation of the rhenium oxides were determined. Author

N70-10481# Tufts Univ., Medford, Mass.
STUDY OF COMBUSTION IN AN ANNULUS HAVING A ROTATING INNER CYLINDER Final Report, Mar. 1968–31 Dec. 1968
Kenneth N. Astill 1 Jul. 1969 92 p refs
(Contract DA-31-124-ARO-D-350)
(AD-692318) Avail: CFSTI CSCL 21/2

A survey of the literature is presented relating to the occurrence of Taylor vortices in annular ducts. These are collected in graphical form and extrapolated by combining theories. Results of experiments on transition in annuli of several gap sizes are given. These include the effects of axial velocity, distance from the inlet, and radial position. Two-length effects are shown to exist: the length to establish transition, and the length for the disturbance to fill the gap. Transition points are compared through use of a displacement-thickness Taylor number. It is shown that this number is affected by gap size. Curves of Taylor number versus Reynolds numbers exhibit a reverse bend suggesting transition to a different mode of flow at the large Reynolds numbers. Author (TAB)

N70-10485# Denver Research Inst., Colo.
PYROLYSIS AND COMBUSTION OF LITHIUM ALUMINUM HYDRIDE Final Report
William H. Mc Lain and Franklin I. Honea May 1969 42 p refs
(Contract AF-AFOSR-1079-68)
(AD-692527; DRI-2504; AFOSR-69-2052TR) Avail: CFSTI CSCL 21/9.2

The slow pyrolysis of lithium aluminum hydride proceeds by a successive dehydrogenation of the fuel in three stages over a temperature range between 210 degrees and 460 degrees C. The combustion of lithium aluminum hydride follows a simular multistage process in which the pyrolytic dehydrogenation is followed by an afterburning of the metal substrate. Experimental studies

were performed to determine the delay times between successive stages for solid mixtures of lithium aluminum hydride with selected oxidizers. Time resolved spectrographic techniques were used to determine the duration of these stages. Studies were performed using Li2O2 and NH4NO3 oxidizers over a particle size range between 75-300 microns and O/F mixture ratios of between 0.5 and 3.0. Ignition delay times for the initial reaction were found to vary between 5 and 40 milliseconds for the first stage and 10 to 120 milliseconds for the second stages. An analytical model was developed to describe the observed multistage combustion process. The model and resulting PARTIG computer program utilize the nodal approach with stepwise solution of the equations for heat and mass transfer. Author (TAB)

N70-10588*# Rice Univ., Houston.
CONDENSERS AND OR EVAPORATORS IN CONVECTIVE AND RADIATIVE ENVIRONMENTS
D. B. Mackay and G. R.Brown Apr. 1969 87 p
(Grant NGR-44-006-033)
(NASA-CR-106651; ATR-5) Avail: CFSTI CSCL 20M

Two digital programs, numbers 5-1 and 5-2, for analyzing steady-state performance of heat exchanger systems, are presented. These programs are restricted to systems where the principal source or sink for the heat is attributable to latent heat of the fluid which passes through ducts located in the exchanger. Program 5-1 is restricted to the analysis of circular ducts having two symmetrically located single section fins. The radiation environment may include the effects of three external bodies. Fin performance is established by a Runga-Kutta-Gill numerical integration routine. Program 5-2 analyzes complicated duct and fin configurations. Pressure drops for irregular duct shapes are calculated assuming an effective diameter equal to four times the hydraulic mean radius. Author

N70-10589*# McDonnell-Douglas Astronautics Co., Santa Monica, Calif. Advance Biotechnology and Power Dept.
THE EFFECT OF ATMOSPHERE SELECTION AND GRAVITY ON BURNING RATE AND IGNITION TEMPERATURE
R. A. Neustein, P. P. Mader, G. V. Colombo, and D. E. Richardson Oct. 1968 60 p refs
(Contract NASw-1539)
(NASA-CR-106652; DAC-62431) Avail: CFSTI CSCL 20M

Baseline test specimens were selected and new test data presented in the reference, which helped to evaluate the relative effect of atmosphere composition on burning rate and ignition phenomena. The effort was continued and tests were completed that permit a better understanding of the effects of null gravity, elevated gravity, and ventilation rate on atmosphere selection from a fire prevention standpoint. An analytical correlation was completed and an equation presented for extrapolating test data from one gravity level to another for the cotton cloth specimen tested. A KC-135 aircraft was used to obtain the null-gravity data and a 10-ft radius centrifuge was used to obtain controlled elevated -gravity data. The spectrum of gravity levels evaluated are considered representative of those that could be encountered during vehicle ground checkout, launch entry, and spaceflight. Additionally, new data were obtained to permit the comparison of neon diluent from a fire prevention aspect to helium and nitrogen, the evaluation of the preignition and post-ignition decomposition products of the test specimen for application to fire detection, and the evaluation of the potential of inert gaseous nitrogen and helium for their individual fire extinguishing capability. Author

N70-10714# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE THEORETICAL INVESTIGATION OF HEAT EXCHANGE IN A PLANE-PARALLEL DUCT UNDER CONDITIONS OF THE FORCED FLOW OF A HEAT-RELEASING FLUID
P. V. Tsoi et al Mar. 1969 11 p refs Transl. into ENGLISH from Akad. Nauk BSSR, Dokl. (Minsk), v. 12, no. 4, 1968 p 319–323
(AD-690398; FTD-HT-23-102-69) Avail: CFSTI CSCL 20/13

Heat exchange is investigated under conditions of forced convection in a hollow duct with a heat source whose power density is distributed in the fluid stream according to a given law. The problem is reduced to solving a boundary value problem, and the equation is transformed through the introduction of dimensionless coordinates. The variation of the heat flux at the walls of the hollow duct during the flow of the heat-releasing fluid is plotted in a graph for given values. Author (TAB)

N70-10715# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MUFFLE METHODS FOR DETERMINING FLAME RESISTANCE OF POLYMER AND OTHER MATERIALS
A. E. Khoroshaya et al Mar. 1969 9 p refs Transl. into ENGLISH from Vsesoyuznyi Nauchno Issled. Inst. Plenochnykh Materialov i Iskustv. Kozh. Nauchno-Issled. Trudy (USSR), v. 17, 1966 p 187–191
(AD-690381; FTD-HT-23-1133-68) Avail: CFSTI CSCL 21/2

Flame resistance of synthetic and natural polymeric materials was examined in a muffle by increasing the temperature in the muffle by 50 degrees with each successive 0.5-g. sample if the preceding one of the same material did not inflame. After inflammation, the temperature was decreased by 30 degrees for the next sample. The temperatures of inflammation are tabulated for 24 different materials. Author (TAB)

N70-10823# Naval Weapons Station, Yorktown, Va. Explosives Engineering and Research Dept.
EVALUATION OF LOW COST ALUMINUM ALLOY GRANULES FOR USE IN ALUMINIZED EXPLOSIVES
Winona C. Hogge 8 Aug. 1969 21 p refs
(AD-692432; NWSY-TR-69-2) Avail: CFSTI CSCL 19/1

This report covers the evaluation of low cost aluminum alloy granules for use in aluminized explosives, i.e. Tritonal, DESTEX and H-6. The alloy was evaluated with respect to its effects on batching characteristics, composition uniformity, thermal stability and impact sensitivity of the explosive systems. A comparison was made of the alloy and currently used atomized aluminum with respect to particle size and chemical composition. Author (TAB)

N70-10885# Los Alamos Scientific Lab., N. Mex.
MEASUREMENT OF THE THERMAL CONDUCTIVITY OF HYDROGEN BETWEEN 2000 and 7000 K
K. Behringer et al [1968] 33 p refs Transl. into ENGLISH from Z. Physik (Berlin), no. 215, 1968 p 127–151
(LA-tr-68-51) Avail: CFSTI

Experimental and theoretical investigations were performed to determine the thermal conductivity of hydrogen in the temperature range between 2000 and 7000 deg K. For this purpose, the radial temperature distributions for various currents and the E-I-characteristic of a low-current wall-stabilized hydrogen arc were measured. When the radial distribution of power input and the temperatures are known, the thermal conductivity between 4500 and 7000 deg K can be determined as well. The total course of the heat conductivity shows a strong peak at the temprature of 3740 deg K characteristic for the dissociation process. Author (NSA)

N70-10888# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
THERMAL AND HYDRODYNAMIC STUDY OF A WHIRLING LIQUID HYDROGEN LAYER UNDER HIGH HEAT FLUX [ETUDE THERMIQUE ET HYDRODYNAMIQUE D'UNE COUCHE TOURBILLONNAIRE D'HYDROGENE LIQUIDE SOUS FLUX DE CHALEUR ELEVE]
Rolf Ewald (Kernforsch. G.m.b.H., Karlsruhe; Ph.D. Thesis, Grenoble

Univ., 21 Mar. 1968) Aug. 1969 104 p refs In FRENCH; ENGLISH summary
(CEA-R-3560) Avail: CFSTI

In order to achieve a cold neutron source ($\lambda \geq 4$ Å) in a high flux reactor ($\approx$ 10(15) neutrons/sq cms), whirling liquid hydrogen layer (145 mm OD, effective thickness 15 mm, height about 180 mm) was formed, out-of-pile, in a cylindrical transparent glass vessel. The whirling motion was obtained by tangential injection of the liquid near the wall. Thermal and hydrodynamic conditions for the formation of such a layer were studied, together with laws of similarity. The characteristics of this whirling flow were observed as a function of mass flow rate (5 to 27 g/s; 4.3 to 23 l/mn), and spillway width (18 and 25 mm). Six different nozzles were used: 1.0; 1.5; 1.9; 2.25; 2.65 and 3.0 mm ID. The total heat influx was found to be between 8.6 and 10.4 kW. The heat flux density was about 9.4 W/sq cm and the mean layer density around 80 per cent of that of the liquid hydrogen at 20.4 K. High speed films were used to analyze the boiling region. Author (ESRO)

N70-10876# Akademiya Nauk URSR, Kiev.
PROCESSES OF COMBUSTION AND HEAT TREATMENT OF MATERIALS
1967 92 p refs In RUSSIAN
Avail: CFSTI

CONTENTS:

1. ANALYTICAL INVESTIGATION OF THE THERMAL GRANULATION PROCESS OF A SEMIDISPERSED MATERIAL IN SUSPENSION G. L. Babukha and A. A. Shraiber p 7–15 refs (See N70-10877 01-33)

2. SOME PROBLEMS OF INVESTIGATING THE COMBUSTION OF GASES IN BURNERS WITH POROUS, RADIANT NOZZLES V. F. Zanemonets, M. A. Kondak, and N. V. Lesovoy p 16–23 refs (See N70-10878 01-33)

3. SOME CHARACTERISTIC OPERATIONAL FEATURES OF JET-STABILIZED GAS BURNERS UNDER VARIABLE CONDITIONS G. N. Lyubchik and V. A. Khristich p 24–34 refs (See N70-10879 01-33)

4. ON DESIGNING GAS EJECTION BURNERS G. P. Dobrovolskiy p 35–39 (See N70-10880 01-28)

5. ON RADIATIVE HEAT TRANSFER IN RAPID ANNEALING FURNACES N. A. Zakharikov and Ye. I. Nikolayev p 40–43 (See N70-10881 01-33)

6. EXPERIMENTAL STUDY OF THE AGGREGATION PROCESS OF A DISPERSED MATERIAL IN A VERTICAL GAS FLOW G. L. Babukha and P. T. Smenkovskaya p 44–49 refs (See N70-10882 01-33)

7. EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER BETWEEN A WATER-COOLED STABILIZER AND A GAS JET Yu. N. Bashkatov, L. S. Butovskiy, and V. A. Khristich p 50–55 refs (See N70-10883 01-33)

8. GASIFICATION OF COAL ENRICHMENT WASTES S. G. Vesselman, L. V. Drobyshev, and N. Ye. Luginin p 56–62 refs (See N70-10884 01-33)

9. THE DEPENDENCE OF GAS PRODUCTION COSTS ON THE DEGREE OF OXYGEN BLAST ENRICHMENT DURING GASIFICATION OF LIGNITE UNDER PRESSURE G. N. Khopta p 63–67 refs (See N70-10885 01-33)

10. ON THE PROBLEM OF MEASURING FLAME TEMPERATURE BY THE METHOD OF ZERO DIAMETER EXTRAPOLATION V. S. Pikashov, V. P. Kononko, G. V. Ryabchenko, and L. I. Nazarenko p 69–76 refs (See N70-10886 01-33)

11. THE HYDRODYNAMICS OF A BOILING LAYER OF CAPRONE RESIN GRANULES L. M. Mishnayevskiy and N. A. Sharkova p 77–85 refs (See N70-10887 01-06)

12. HEAT TRANSFER IN CARBON PYROLYSIS PROCESSES A. V. Stepanov p 86–92 refs (See N70-10888 01-33)

N70-10877# Akademiya Nauk URSR, Kiev.
ANALYTICAL INVESTIGATION OF THE THERMAL GRANULATION PROCESS OF A SEMIDISPERSED MATERIAL IN SUSPENSION
G. L. Babukha and A. A. Shraiber *In its* Processes of Combust. and Heat Treat. of Mater. 1967 p 7–15 refs In RUSSIAN (See N70-10876 01-33)
Avail: CFSTI

In a two-phase flow of a semidispersed material, there are frequent collisions of particles due to the difference in rates of motion of different size particles. Besides the continuously acting forces of weight and aerodynamic drag, each particle is acted upon by the other particles in the flow. Therefore, the velocity of particles of a given size in the same flow cross section is not a specific value, but a range of values determined by the frequency and force of collisions at a given moment in time. Collisions between particles cause them to agglomerate at specific temperature and hydrodynamic conditions and the mass of each particle varies along the flow path due to accumulation of other particles or developing granules. A set of equations is constructed to calculate the process of thermal granulation of the dispersed material. Transl. by R.B.

N70-10878# Akademiya Nauk URSR, Kiev.
SOME PROBLEMS OF INVESTIGATING THE COMBUSTION OF GASES IN BURNERS WITH POROUS, RADIANT NOZZLES
V. F. Zanemonets, M. A. Kondak, and N. V. Lesovoy *In its* Processes of Combust. and Heat Treat. of Mater. 1967 p 16–23 refs In RUSSIAN Prepared jointly with Kiev Polytech. (See N70-10876 01-33)
Avail: CFSTI

The technology of manufacturing nozzles for radiant gas burners is investigated and results are presented of studying their stable operation as a function of operating conditions and grain size of the nozzle material. Experiments show that metal oxide activation of the nozzles adversely affects their quality, but has no appreciable effect on the combustion process. The thermal load of burner nozzles can be increased several times by using special porous refractory ceramic materials. Aluminum oxide ceramics are especially suitable because of their high heat resistance and chemical stability in the presence of aggressive reagents. Transl. by R.B.

N70-10879# Kiev Polytechnic (USSR).
SOME CHARACTERISTIC OPERATIONAL FEATURES OF JET-STABILIZED GAS BURNERS UNDER VARIABLE CONDITIONS
G. N. Lyubchik and V. A. Khristich *In* Akad. Nauk URSR Processes of Combust. and Heat Treat. of Mater. 1967 p 24–34 refs In RUSSIAN (See N70-10876 01-33)
Avail: CFSTI

Experiments show that one of the main operational characteristics of fuel burning devices is self-regulation of the combustion process. This self-regulation of fuel atomization and combustion in jet-stabilized burners maintains its efficiency under any conditions of varying the flow rate of air. Self-regulation is determined by the fact that the length of the elementary jets along the stabilizer essentially depends on the rate of the gas flow, and consequently, on fuel consumption. Transl. by R.B.

N70-10881# Akademiya Nauk URSR, Kiev.
ON RADIATIVE HEAT TRANSFER IN RAPID ANNEALING FURNACES
N. A. Zakharikov and Ye. I. Nikolayev *In its* Processes of Combust. and Heat Treat. of Mater. 1967 p 40–43 In RUSSIAN (See N70-10876 01-33)
Avail: CFSTI

The most rapid annealing of thin materials in a gas-fired furnace takes place when the radiant burners completely cover the

furnace cupola, but in this case, operation of the furnace is complicated by the large number of burners. This problem can be overcome by reducing the number of burners and by positioning them at some distance from each other. The annealing time of the material may then remain constant if the reduction in the apparent coefficient of radiative heat transfer is compensated for by an increase in the radiant surface temperature of the burners.
Transl. by R.B.

N70-10882# Akademiya Nauk URSR, Kiev.
EXPERIMENTAL STUDY OF THE AGGREGATION PROCESS OF A DISPERSED MATERIAL IN A VERTICAL GAS FLOW
G. L. Babukha and P. T. Smenkovskaya *In its* Processes of Combust. and Heat Treat. of Mater. 1967 p 44–49 refs In RUSSIAN (See N70-10876 01-33)
Avail: CFSTI

The intensity of the physicochemical processes between multi-component dispersed materials during heat treatment of them depends both on the temperature of the process and the contact surface of the particles. Aluminum powder with spherical particles up to 300 microns in diameter was used to confirm whether aggregation of a dispersed material in suspension is possible. Experiments show that, after a brief period in the circulation cycle at a temperature of 773 to 923 deg K, the main mass of the powder forms aggregates of 5 to 7 particles due to the impact of melted particles. However, aggregation of particles in suspension requires a temperature exceeding their melting point, because they are in contact for only fractions of a second. Transl. by R.B.

N70-10883# Kiev Polytechnic (USSR).
EXPERIMENTAL INVESTIGATION OF HEAT TRANSFER BETWEEN A WATER-COOLED STABILIZER AND A GAS JET
Yu. N. Bashkatov, L. S. Butovskiy, and V. A. Khristich *In* Akad. Nauk URSR. Processes of Combust. and Heat Treat. of Mater. 1967 p 50–55 refs In RUSSIAN (See N70-10876 01-33)
Avail: CFSTI

Natural gas with a high calorific value was burned in a cylindrical combustion chamber 530 mm in diameter with a flat burner consisting of 28 radial stabilizers. Results show that heat transfer between the stabilizer and jet depends on the method of fuel delivery, on flow velocity, and on the extent of preheating the gases in the combustion zone. The experimental data are given in standardized format. Transl. by R.B.

N70-10884# Akademiya Nauk URSR, Kiev.
GASIFICATION OF COAL ENRICHMENT WASTES
S. G. Vesselman, L. V. Drobyshev, and N. Ye. Luginin *In its* Processes of Combust. and Heat Treat. of Mater. 1967 p 56–62 refs In RUSSIAN (See N70-10876 01-33)
Avail: CFSTI

Coal enrichment wastes with a low yield of volatile materials were separated by specific weight and subjected to gasification in an air blast gas generator. Gas samples were withdrawn from the lower section of the fuel layer at some distance from the fire grate and temperature measurements were made periodically at a specific time to determine the thickness of the layer. The experiments show that coal enrichment wastes are suitable raw materials for extracting fuel gas. The temperature of the fuel layer in the generator should not exceed the softening temperature of the ash, and both the temperature and thickness of the fuel layer should be increased to improve the quality of the extracted gas. The rate of gasification does not depend on the ash content of the waste materials. Transl. by R.B.

N70-10885# Akademiya Nauk URSR, Kiev.
THE DEPENDENCE OF GAS PRODUCTION COSTS ON THE DEGREE OF OXYGEN BLAST ENRICHMENT DURING GASIFICATION OF LIGNITE UNDER PRESSURE
G. N. Khopta *In its* Processes of Combust. and Heat Treat. of Mater. 1967 p 63–67 refs In RUSSIAN (See N70-10876 01-33)
Avail: CFSTI

On the basis of experimental studies, capital outlays to equip gas works of identical thermal output with gas are hardly dependent on the degree of oxygen blast enrichment and they reach a minimum when oxygen content in the blast is 60%. Operational expenditures for producing a thermal unit of gas increase as the oxygen content in the blast increases. Minimum expenditures are required for air enriched gas and comprise 9.8 million rubles, which is 10% less than those required for oxygen enriched gas. Fuel expenditures for power requirements increase as oxygen concentration in the blast increases, and, with 100% oxygen enrichment, they exceed the fuel expenditure level by 74% compared to the power requirements for air enrichment. Transl. by R.B.

N70-10886# Akademiya Nauk URSR, Kiev.
ON THE PROBLEM OF MEASURING FLAME TEMPERATURE BY THE METHOD OF ZERO DIAMETER EXTRAPOLATION
V. S. Pikashov, V. P. Kononko, G. V. Ryabchenko, and L. I. Nazarenko *In its* Processes of Combust. and Heat Treat. of Mater. 1967 p 69–76 refs In RUSSIAN (See N70-10876 01-33)
Avail: CFSTI

When compared with other methods, zero diameter extrapolation is more advantageous in measuring local temperatures of gas flows and flames. A probe consisting of three thermocouples of identical shape, but different sizes is employed to measure flame temperature at a specific point. As thermocouple size decreases to zero, convective flow becomes completely predominant over radiant flow, and the temperature indicated by the theoretical zero diameter thermocouple is the true temperature of the gas. The probe is calibrated by comparing successive gas temperature readings of the thermocouples with measurements made by a suction thermocouple, the error of which is assumed to be zero and the indicated temperature of which is assumed to be the true temperature of the gas. Transl. by R.B.

N70-10888# Akademiya Nauk URSR, Kiev.
HEAT TRANSFER IN CARBON PYROLYSIS PROCESSES
A. V. Stepanov *In its* Processes of Combust. and Heat Treat. of Mater. 1967 p 86–92 refs In RUSSIAN (See N70-10876 01-33)
Avail: CFSTI

The intensity of heat and mass transfer in a pyrolysis reaction vessel has a strong effect on the pyrolysis process and the yield of specific products. At the same time, chemical conversions in the system affect the intensity of heat and mass transfer. An experimental pyrolysis furnace is described in which compressed propane-butane gas is used as a raw material. The gradient type furnace has radiant and convection chambers with vertical flow of flue gases. Results show that the presence of decomposition reactions in the reaction vessel increases the intensity of heat transfer. The heat transfer coefficient determined from experiment is 1.5 to 2 times greater than that found by standard functions without regard to chemical conversions. This increase in intensity is caused by an increase in the specific heat of the system.
Transl. by R.B.

N70-11013# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Inst. für Strahlantriebe.
EXPERIMENTAL INVESTIGATIONS OF EFFICIENCY OF ARC HEATING WITH A COAXIAL CYLINDER IN A TRANSVERSE MAGNETIC FIELD [EXPERIMENTELLE UNTERSUCHUNGEN UEBER DEN WIRKUNGSGRAD BEI DER

LUFTAUFHEIZUNG MIT HILFE EINES ZWISCHEN KOAXIALEN ZYLINDERN IM TRANSVERSALEN MAGNETFELD BRENNENDEN LICHTBOGENS]
Rudolf Ferdinand Neubauer May 1969 40 p refs In GERMAN; ENGLISH summary Sponsored by Federal Defense Min.
(DLR-FB-69-36) Avail: CFSTI

Experimental data on the efficiency and power loss at the electrodes of an arc heater, which produces a hot-gas stream expanding against atmospheric pressure, is reported. The efficiency can reach 70% and depends mainly on the polarity of the electrodes and the mass flow rate of air. The power loss at the outer electrode is about three times higher than at the inner electrode. The main results are discussed. Author (ESRO)

N70-11054# Lockheed Missles and Space Co., Palo Alto, Calif.
TEMPERATURE MODE OF SOLIDS UNDER COMBINED RADIATION AND CONVECTION
V. V. Salomatov 1969 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. i Transport (USSR), no. 4, 1969 p 91–99
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The problem of nonstationary heat conduction in solids with the joint transmission of heat by radiant and convective heat fluxes permits an exact analytical solution in the quasistationary stage. The initial stage is computed by approximation functions obtained by the Karman-Polhausen method from boundary layer theory. Nomograms are proposed which provide for accelerated computation of heating dynamics. Author

N70-11098# Atlantic Research Corp., Alexandria, Va. Propulsion Div.
AN OPTICAL BOMB STUDY OF THE COMBUSTION OF SOLID PROPELLANTS IN HIGH ACCELERATION FIELDS Annual Technical Report, 1 May 1968–30 Apr. 1969
Merrill K. King and Edward T. Mc Hale Jul. 1969 38 p refs
(Contract N00014-67-C-0455)
(AD-691291; Rept-2) Avail: CFSTI CSCL 21/2

An experimental study of the effects of acceleration fields on the burning rate of solid propellant grains is being conducted. A variety of formulations are being studied over a range of pressures and acceleration loadings; the results will eventually be used to evaluate theoretical models of the process or to form the basis for improved models. The acceleration vector, produced by spinning a disc-shaped propellant in a large volume optical bomb, can be directed perpendicularly into or away from the burning surface. Three formulations have been studied to date under both vector orientations. Author (TAB)

N70-11149*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ISOTHERMAL COVER WITH THERMAL RESERVOIRS Patent Application
Ambrose W. Byrd, inventor (to NASA) Filed 30 Jul. 1969 12 p
(NASA-Case-MFS-20355; US-Patent-Appl-SN-845974) Avail: CFSTI CSCL 20M

An isothermal cover for a spacecraft is described. The device is a double-walled cylinder enclosing a number of containers of fusible material, mounted on struts inside the walls of the cylinder, for use as heat reservoirs. The inside surfaces of the cylinder and the outside surfaces of the containers and struts are covered with a wicking material. The struts may also be fabricated solely of the wicking material. The cavity of the double-walled cylinder also contains a heat transfer fluid. The device functions as a heat pipe in transferring heat from its sunlit to its other (dark) side. The heat reservoirs store heat when the device is in sunlight and return the heat to the system when the device is in darkness. Electrical heaters also furnish heat to the system if needed to keep the system at constant temperature. NASA

N70-11156# Lockheed Missiles and Space Co., Palo Alto, Calif.
HEAT EXCHANGE ON A HALF-CONE SURFACE AT HYPERSONIC SPEEDS
V. Ia. Borovoi et al 1969 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 4, 1969 p 137–142
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The formation of narrow zones of intense heat exchange on the surface of a blunt hypersonic half-cone were studied at Mach 5 and 6 in wind tunnel tests. Comparison between results of measuring heat flux without and with a baffle, as well as shock wave shadowgraphs, indicated that a pressure drop on the conical and plane surfaces resulted in the formation of separation and vortice flows. When the magnitude of the half-cone bluntness diminished, the lines of boundary layer attachment came together and maximum values of the heat transfer coefficient were reduced substantially. As the angle of attack increased, the heat transmission coefficient dropped. G.G.

N70-11166# Arizona Univ., Tucson. Energy Mass and Momentum Transfer Lab.
INTERNAL LAMINAR HEAT TRANSFER TO A GAS WITH TEMPERATURE DEPENDENT PROPERTIES Interim Technical Report
Thomas Burke Swearingen May 1969 162 p refs
(Contract DA-31-124-ARO(D)-314)
(AD-692317; EMMT-LAB-TR-1; AROD-5403-13-E) Avail: CFSTI CSCL 20/13

The results of an analytical and experimental investigation of internal laminar heat transfer to a gas with temperature dependent properties is reported. The analytical investigations obtains numerical solutions for the differential equations of energy, momentum, and continuity describing the laminar flow of an ideal gas between heated parallel plates. The experimental study considers heat transfer to laminar flow of air and helium inside an electrically heated circular tube. Author (TAB)

N70-11169# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF WICK GEOMETRY ON THE OPERATION OF A LONGITUDINAL HEAT PIPE
Hugh Edward Kilmartin, Jr. (M.S. Thesis) Jun. 1969 70 p refs
(AD-692442) Avail: CFSTI CSCL 13/1

Evaporative heat transfer limits were obtained and studied for an everted heat pipe with varying wick geometries. The wick geometries were a function of the wire mesh size and the total wick thickness. A nickel heat pipe was built and operated using both water and ethyl alcohol as the working fluids. The different wick materials used were 50 mesh, 80 mesh, and 150 mesh, plain weave, nickel wire cloth. The scope of the investigation included operating the pipe at 25 inches mercury vacuum, 10 inches mercury vacuum, and 5 pounds per square inch gage. The maximum heat transfer was found to increase as the mesh size was decreased, as the wick thickness was increased, or as the pressure was increased. The equipment used to obtain experimental data is described and experimental results and sample calculations are presented. Author (TAB)

N70-11173# Argonne National Lab., Ill.
THE THERMODYNAMIC PROPERTIES OF P SUB 2, P SUB 4, AND SOME PHOSPHORUS FLUORIDES
P. A. G. O'Hare Dec. 1968 33 p refs
(Contract W31-109-eng-38)
(ANL-7459) Avail: CFSTI

Thermodynamic functions were calculated for the ideal gas molecules P sub 2, P sub 4, PF, PF sub 2, PF sub 3, PF sub 4, PF sub 5, and P sub 2 F sub 4, by the formulas of statistical mechanics. The quantities Delta Hf, Delta G, and log Kf, are also

given; where experimental values were not available, estimates were made. The thermodynamic data were calculated at selected intervals between 0 and 6000 K, and also at 273.15 and 298.15 K. Some thermodynamic aspects of the reactions of phosphorous fluorides are discussed. Author (NSA)

N70-11219# Army Foreign Science and Technology Center, Washington, D.C.
THERMOELECTRIC COOLING DEVICES
E. A. Kolenko 26 Jun. 1969 347 p refs Transl. into ENGLISH of the book 'Termoelektricheskiye Ckhlazhdayuschiye Pribory' Leningrad, USSR, 1967 p 1–257
(AD-691974; FSTC-HT-23-435-68) Avail: CFSTI CSCL 13/1

The book is dedicated to one of the youngest but rapidly developing fields of contemporary refrigeration engineering – –that of thermoelectric cooling. The physical nature of thermoelectric cooling is set forth in an accessible format, with design and construction methods for thermoelectric cooling devices intended for various purposes. Various thermoelectric cooling devices are described which are intended for use in scientific practice and engineering. A large section of the book is devoted to the utilization of thermoelectric cooling in medicine. Author (TAB)

N70-11238# Bölkow G.m.b.H., Ottobrunn bei München (West Germany). Space Dept.
DETERMINATION OF PHYSICAL AND TECHNOLOGICAL PROPERTIES OF SUPERINSULATION [BESTIMMUNG VON PHYSIKALISCHEN UND TECHNOLOGISCHEN EIGENSCHAFTEN VON SUPERISOLIERUNG]
E. Müller Jul. 1969 40 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.
(BMWF-FB-W-69-24) Avail: CFSTI

Several properties of NRC-2 superinsulation, of interest for its use as insulation on cyrogenic spacecraft tanks, were determined. The experiments were concerned with longitudinal and transversal heat conductivity, specific heats, surface properties, gas permeability, content of gases, humidity, and inflammability. The measurements were carried out at different temperatures. The cryogenic liquids used were liquid nitrogen and hydrogen. Author (ESRO)

N70-11239# Rocket Propulsion Establishment, Westcott (England).
STUDIES OF COMBUSTION IN WELL-STIRRED REACTORS: AN ANNOTATED BIBLIOGRAPHY
P. T. Hinde Mar. 1969 12 p refs
(RPE-TM-498) Avail: CFSTI

The 41 items contained in the bibliography are thought to provide a fairly comprehensive listing of basic combustion studies using well-stirred reactors. A particular attempt has been made to include all papers reporting rate data. Items are listed in chronological order. Author (ESRO)

N70-11285# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
TABLES OF EQUILIBRIUM THERMODYNAMIC PROPERTIES OF NITROGEN. VOLUME 4: CONSTANT TEMPERATURE WITH SPECIFIC HEAT AND SPEED OF SOUND DATA Final Report, Jan. 1966–Jan. 1968
Herbert S. Brahinsky and Charles A. Neel Aug. 1969 155 p refs Prepared in cooperation with Aro, Inc.
(Contract F40600-69-C-0001)
(AD-692172; AEDC-TR-69-126-Vol-4) Avail: CFSTI CSCL 20/13

Equilibrium thermodynamic data are presented for nitrogen from a temperature of 100 to 15,000K and from a log rho of -7.0 to 3.0, where rho is density in amagats. These data are tabulated at constant temperature with density incremented. Several sources were used in assembling the data. Author (TAB)

N70-11394*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
COMBUSTION OF CERTAIN ORGANIC PERCHLORATES [O GORENII NEKOTORYKH ORGANICHESKIKH PERKHLORATOV]
V. D. Aleshin et al Washington NASA Nov. 1969 7 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Dokl. (USSR), v. 185, 1 Apr. 1969 p 856–859
(Contract NASw-1692)
(NASA-TT-F-12659) Avail: CFSTI CSCL 20M

Study of the combustion of three diperchlorates which differ with respect to the structure of the organic part of their molecules and with respect to their heats of explosive transformation. It is shown that these substances burn very quickly. The combustion velocity of tetramethylenediamine diperchlorate is found to be inhibited by pressure in the range from 37 to 200 atm, while up to 37 atm, and above 200 atm., the combustion velocity increases with an increase in pressure. Author

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N70-10127# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 209
31 Jul. 1969 45 p refs
(JPRS-48527) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1 ref (See N70-10128 01-30)
2. METEOROLOGY p 2–6 refs (See N70-10129 01-20)
3. OCEANOGRAPHY p 7–10 refs (See N70-10130 01-13)
4. TERRESTRIAL GEOPHYSICS p 11–24 refs (See N70-10131 01-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 25–39 refs (See N70-10132 01-13)

N70-10145# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS
William M. Leak, ed. Sep. 1969 53 p
(NAVSO-P-3012) Avail: CFSTI

Discussions are presented on radiation sources for stellar telescopes and surface chemistry of reinforced plastics. Summaries of significant technical progress are also presented for individual problems. These problems include the following areas of investigation: acoustic radiation theory, underwater electroacoustic measurements methods, IFF identity readout system, angular scattering functions for cloud droplets, effects of static dissipator additive and fuel oil on the charging tendency of jet fuels, simplified dc-to-dc static converter, periodic left factors of meromophic functions, cleavage cracking and surface trace analysis in Ti–8Al–1Mo–1V alloy, basic studies of metallic state, wustite growth on iron in CO2–CO atmospheres, yield strength of neutron irradiated steel, crack growth and fracture toughness of high strength metals, foam separation used in chemical oceanography, pulse radar maximum-range calculation, and patents on photoconductive detector, reciprocal conjugate pair feed system for antenna array, and waste chemical disposal apparatus. (For individual titles, see N70-10146 and N70-10147.) N.E.N.

N70-10245# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 206
13 Jun. 1969 104 p refs
(JPRS-48226) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1–3 refs (See N70-10246 01-30)
2. METEOROLOGY p 4–25 refs (See N70-10247 01-20)
3. OCEANOGRAPHY p 26–50 refs (See N70-10248 01-13)
4. TERRESTRIAL GEOPHYSICS p 51–66 refs (See N70-10249 01-13)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 67–94 refs (See N70-10250 01-13)

N70-10382# Library of Congress, Washington, D.C. Aerospace Technology Div.
FOREIGN SCIENCE BULLETIN, VOLUME 5, NO. 10
Oct. 1969 70 p refs
Avail: Issuing Activity

Discussions are presented on Soviet solutions to space exploration problems and on papers presented at an international symposium on electrosleep and electroanesthesia. Brief descriptions are also given of ship-borne power plants, cortical–subcortical interrelations under conditions of electroanesthesia, a radiometer system to analyze the radiation environment at altitudes of 200-400 km, a photogalvanic battery as a chloroplast model, the chemical identification of element 104, Soviet conferences on the theory of games and automata, and the development of instruments for cardiovascular medicine. See N70-10382-N70-10384. N.E.N.

N70-10417# Joint Publications Research Service, Washington, D.C.
SELECTIONS FROM VOPROSY FILOSOFII, NO. 3, 1969
16 Jun. 1969 34 p refs Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 3, 1969 p 23–33 and 34–43
(JPRS-48238) Avail: CFSTI

CONTENTS:

1. THE INFLUENCE OF THE SCIENTIFIC AND TECHNICAL REVOLUTION ON THE NATURE OF OUR PLANET A. Ye. Medunin p 1–17 refs (See N70-10418 01-34)
2. CRITERIA OF CHOICE: A COMPLEX PROBLEM OF THE SCIENCE OF SCIENCE G. M. Dobrov p 18–31 refs (See N70-10419 01-34)

N70-10418# Joint Publications Research Service, Washington, D.C.
THE INFLUENCE OF THE SCIENTIFIC AND TECHNICAL REVOLUTION ON THE NATURE OF OUR PLANET
A. Ye. Medunin *In its* Selections from Vopr. Filosofii, no. 3 1969 16 Jun. 1969 p 1–17 refs (See N70-10417 01-34)
Avail: CFSTI

The effects of the technological revolution on man, animal, and plant are discussed emphasizing the adverse consequences. These include air and water pollution, increase of noise in cities, soil erosion, soil pollution by insecticides and pesticides, presence of radioactive materials, and increased level of heat. The industrial and social causes of these pollutions are identified, and estimations of future trends are given. It is felt that the problem is solvable since industrial discharges can be neutralized and other harmful consequences can be eliminated. It is also pointed out that expanding and strengthening national and international legislation on questions relating to natural resources can contribute to a satisfactory solution. N.E.N.

N70-10419# Joint Publications Research Service, Washington, D.C.
CRITERIA OF CHOICE: A COMPLEX PROBLEM OF THE SCIENCE OF SCIENCE
G. M. Dobrov *In its* Selections from Vopr. Filosofii no. 3 1969 16 Jun. 1969 p 18–31 refs (See N70-10417 01-34)
Avail: CFSTI

A generalized discussion is presented on observations relating to the problem of choosing the directions of research work. The accelerated pace of scientific and technological achievements is described along with the resulting importance of the timing of an invention and the increased need for criteria of choice. These criteria are discussed with respect to reliability of forecasting, economic estimates, industrial systems, systems, industrial and national policy, and moral and ethical considerations. N.E.N.

N70-10580# Hawker Siddeley Dynamics, Ltd., Hatfield (England).
TECHNICAL AND ORGANISATIONAL REQUIREMENTS FOR EARTH OBSERVATION SATELLITE PROGRAMME
B. Buss 1969 10 p Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14–25 Jul. 1969
Avail: CFSTI

An indication of the way in which an earth observation satellite programme might be organised is gained from a study of other satellite applications and other relevant organisations which are already in operation or being planned. These include Intelsat, Intersputnik, WMO and ICAO. It is suggested that an earth observation satellite system should be considered and controlled by either the United Nations with national participation or international consortia similar to Intelsat. ESRO

N70-10641*# Denver Univ., Colo. Dept. of Mechanical Sciences and Environmental Engineering.
PROGRAM FOR THE EXPLOITATION OF UNUSED NASA PATENTS Annual Report, 1 Jun. 1968–31 May 1969
A. Ezra 31 May 1969 186 p refs
(Grant NGL-06-004-078)
(NASA-CR-106648; AR-1) Avail: CFSTI CSCL 05A

The exploitation of unused NASA patents is studied to establish the technical, economic, and marketing feasibility of selected patents. The patents in the area of energy absorbing devices were chosen for investigation. Twelve belonging to NASA, and 36 additional patents were found. It is concluded that: (1)An exclusive license is necessary for a private company to undertake the manufacturing and marketing. (2) The Universities can benefit from the exploitation by sub-licensing to a manufacturer. (3) For the privately owned patents, this program may provide enough stimulus to result in production. F.O.S.

N70-10656# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO 204
14 May 69 p refs
(JPRS-48037) Avail: CFSTI

CONTENTS:

1. ASTRONOMY p 1–8 refs (See N70-10657 01-30)
2. METEOROLOGY p 9–27 refs (See N70-10658 01-20)
3. OCEANOGRAPHY p 28–40 refs (See N70-10659 01-13)
4. TERRESTRIAL GEOPHYSICS p 41–57 refs (See N70-10660 01-14)

5. UPPER ATMOSPHERE AND SPACE RESEARCH p 58–74 refs (See N70-10861 01-30)

6. MISCELLANEOUS p 75 refs (See N70-10862 01-13)

N70-10998# Georgia Inst. of Tech., Atlanta. School of Information Science.

PAPERS ON THE ENGLISH DETERMINERS AND THE BASE STRUCTURE OF THE ENGLISH NOUN PHRASE

James Gough, Jr. 1969 35 p refs

(Grant NSF GN-655)

(PB-185401; GITIS-69-09) Avail: CFSTI CSCL 05G

The three papers represent a progressively deepening insight into the nature of the semiotic process underlying the referential and the quantificational base of the English common-noun symbol and hence the English noun phrase. On the basis of the probings of the first two papers, Paper 3 finally suggests that the base structure of the English noun phrase is best interpreted as a protosentential ostension of the form: THIS+BE+THIS+N. This interpretation levels out the multi-referentiality and the multiquantificationality of the English common noun to an initial sameness. Generation of indefinite and definite reference, singular and plural, common and mass nouns is then accomplished by imposing the Boolean operations of disjunction and/or conjunction on the base formula. The determiners 'a' and 'the' then become symbols representing these semiotic processes. Author (USGRDR)

N70-11007# Georgia Inst. of Tech., Atlanta. School of Information Science.

ON THE METHODOLOGY OF CURRICULAR STUDIES

Vladimir Slamecka 1969 10 p refs

(Grants NSF GN-655; NSF-GE-2557)

(PB-185397; GITIS-69-12) Avail: CFSTI CSCL 05I

The objective of studies of academic programs and their curricula is twofold and mutually dependent. The principal purpose is the development of guidelines permitting and directing the development of quality programs. A corollary of this objective is the evaluation of existing or proposed programs. Both objectives of this type of educational studies thus depend on the development of program models. The goodness of existing and proposed programs is then expressed in terms of the closeness of fit of these programs against such models. The report is intended to explore briefly some methodological aspects of the design and the utilization of models of educational programs. Author (USGRDR)

N70-11014# Committee on Appropriation (U.S. Senate).

INDEPENDENT OFFICES AND DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT APPROPRIATION BILL, 1970

Pastore Washington GPO 1969 32 p refs Presented at the 91st Congr., 1st Sess., 6 Nov. 1969 *Its* Calendar No. 514

(Rept-91-521) Avail: Senate Document Room

The Senate budget report reflecting the new budget concepts is presented with amendments and information relative to the changes. The appropriations are presented for the executive bureaus, boards, commissions, corporations, agencies, offices, and the Department of Housing and Urban Development. A table is included of the comparison of the 1969 budget with the recommended 1970 estimates. N.E.N.

N70-11059# Comissao Nacional de Atividades Espaciais, Sao Jose dos Campos (Brazil).

DESCRIPTION OF THE BRAZILIAN PROGRAM FOR REMOTE SENSING OF EARTH RESOURCES

J. B. Machado Jul. 1969 16 p Presented at the NATO/Brit. Interplanet. Soc. Intern. Summer School on Earth Observation Satellites, Cambridge, Engl., 14–25 Jul. 1969

(LAFE-TR-90) Avail: CFSTI

This paper briefly describes the significance for Brazil of the large and fast area coverage afforded by the use of aircraft and satellites for earth resources surveys, gives a short explanation of the program structure emphasizing the need of integration, new organizational concepts and principles and, the kind of elements which are being provided for program implementation. Author (ESRO)

N70-11110*# Pittsburgh Univ., Pa. Knowledge Availability Systems Center.

THE SPACE AND TECHNOLOGY TRANSFER PROGRAM Annual Report

Edmond Howie Jun. 1969 120 p

(Contract NSR-39-011-089)

(NASA-CR-106707; AR-5) Avail: CFSTI CSCL 05B

The organization and operation of the Knowledge Availability Systems Center (KASC) at the University of Pittsburgh, a facility charged with the responsibility for developing a program of teaching, operations, and research in the field of information science, are described. In addition to the general mission, KASC activities as a Regional Dissemination Center are highlighted, and the scope of marketing and technical operations work during the reporting period is treated. A.C.R.

N70-11195# Royal Greenwich Observatory, Herstmonceux (England). Time and Latitude Service.

GREENWICH TIME REPORT, JULY–SEPTEMBER 1968

R. v. d. R. Woolley Sep. 1968 13 p

Avail: CFSTI

This bulletin lists the results of the photographic zenith tube time and latitude observations made at Herstmonceux during the period of July to September 1968 along with the reception times of radio time signals and standard frequency emissions. Author (ESRO)

N70-11217# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

RESEARCH LABORATORY OF ELECTRONICS Quarterly Progress Report

H. J. Zimmerman, G. G. Harvey, and S. J. Mason 15 Jul. 1969 341 p refs

(Contracts DA-28-043-AMC-02536(E); AT (30-1)-3980; N000-14-67-A-0204-0019; F19628-69-C-0044; Grants NSF GK-10472; NSF GP-8415; NIH 5-PO1-GM14940-03; NIH 2-RO1-NB04332-06; NIH 5-PO1-GM15006-02)

(AD-692201; QPR-94) Avail: CFSTI CSCL 9/3

Contents: Molecular beams; Microwave spectroscopy; Atomic resonance and scattering; Electron magnetic resonance; Radio astronomy; Solid-state microwave electronics; Physical electronics and surface physics; Physical acoustics; Electrodynamics of media; Plasmas and controlled nuclear fusion; Applied plasma research; Speech communication; Linguistics; Cognitive information processing; and Communications biophysics. TAB

N70-11287*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

APOLLO PROGRAM MANAGEMENT, KENNEDY SPACE CENTER, FLORIDA, VOLUME 4

15 Jan. 1968 116 p refs

(NASA-TM-X-61995; Rept-130-12-0001-Vol-4) Avail: CFSTI CSCL 05A

The management functions applied to the Apollo Program Management System at the Kennedy Space Center (KSC) are described. Organizational concepts, management philosophy, and the application of management system elements to respond to the impact of the Apollo Program are considered. An example of the effective use of these management techniques is discussed, and plans for management improvements are highlighted. Author

N70-11286# Georgia Inst. of Tech., Atlanta. School of Information Science.

THE REFERENTIAL STRUCTURES OF THE ENGLISH NOUN PHRASE

James Gough, Jr. and Lucio Chiaraviglio 1969 41 p refs
(Grant NSF GN-655)
(PB-185396; GITIS-69-06) Avail: CFSTI CSCL 05G

The similarity and differences between the tasks accomplished by propositional functions and noun phrase relations may be summarized as follows: (a) propositional functions typically are used in order to analyze monadic and polyadic predication and quantification while noun phrase relations are conjured in order to analyze noun phrase, a subclass of the class of terms; (b) both propositional functions and noun phrase relations relate items in the domain of interpretation of the language to items in the language; and (c) it is possible to capture quantification and definite and indefinite terms by introducing complications on the algebra of propositional functions and it seems probable that the reverse procedure can be accomplished by starting with an algebra of noun phrase relations. Author (USGRDR)

N70-11300# Naval Research Lab., Washington, D.C.

REPORT OF NRL PROGRESS

Jun. 1969 34 p refs
(PB-184460) Avail: CFSTI CSCL 05B

A discussion is presented on X-ray pulsar in the Crab Nebula. Pulsations were observed at a frequency closely matching that of the radio-optical pulsar NP 0532. About 5% of the total X-ray power appears in the pulsed component. Technical progress on individual projects is summarized briefly. These include the following: three dimensional plots of the interaction of a hydrophone array and its associated beamformer; solar X-ray emission during the Apollo 8 flight; adhesive bonding between organic resins and glass or metals; kinetics of molecular hydrogen dissociation and rate of accumulation of hydrogen atoms on a platinum electrode; high amplitude, constant current pulses; graph theorems for solving the four-color problem; dislocation structure in titanium–aluminum binary alloys; titanium alloy microstructures; stress corrosion cracking cleavage in Ti–8Al–1Mo–1V; electron–paramagon scattering in Pt–Ni alloy; high temperature iron oxidation; neutron irradiation of pressure vessel steels; influence of low energy subboundaries on solid–liquid interface stability; and correlation between 5/8-in. and 1-in. tear test energies for steels. N.E.N.

N70-11324# General Electric Co., Philadelphia, Pa. Missile and Space Div.

NEW DIMENSIONS IN PROJECT PLANNING AND CONTROL

James R. Polski and Roy W. Eston 7 Oct. 1969 31 p refs
Presented at the 2d Intern. Congr. on Proj. Planning by Network Analysis, Amsterdam, 7 Oct. 1969
Avail: CFSTI

This discussion is chiefly concerned with schedule and resources planning, and measurement aspects which lead to control, as well as the communications vital to accomplishing this. It will be treating this subject in the context of the design, development, and acquisition phases of the project life cycle. First of all examined are the problems and goals in the planning and control areas; and secondly, described by examples are three developments significant in their effect on the planning and control functions. Author

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